Contract No N68711-03-C-1320

POSTCLOSURE MAINTENANCE PLAN
SITE 14 LANDFILL FINAL COVER
Naval Base Ventura County, Port Hueneme, California

March, 2004

Prepared for:

DEPARTMENT OF THE NAVY
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Naval Facilities Engineering Command
San Diego, California

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ACRONYMS AND ABBREVIATIONS

amsl	Above mean sea level
bgs	Below ground surface
BHC	Benzene hexachloride
CLP	Contract Laboratory Program
CCR	California Code of Regulations
CD-ROM	Compact disk – read only memory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMECC	California Military Environmental Coordination Committee
COC	Chemical of Concern
CPESC	Certified Professional in Erosion and Sediment Control
cm/sec	Centimeters per second
2,4-D	Dichlorophenoxy acetic acid
2,4-DB	Dichlorophenoxy butyric acid
DDD	Dichlorodiphenyl dichloroethane
DDE	Dichlorodiphenyl dichloroethylene
DDT	Dichlorodiphenyl trichloroethane
DFG	California Department of Fish and Game
DQA	Data quality assessment
DTSC	California Department of Toxic Substances Control
EPA	U S Environmental Protection Agency
EPN	Ethyl O-(p-nitrophenyl)phenylphosphonotionate
ft/day	Feet per day
ft/ft	Feet per foot
ft/min	Feet per minute
g	Gravitational acceleration
GCL	Geosynthetic clay liner
GDL	Geosynthetic drainage layer
HELP	Hydrologic Evaluation of Landfill Performance
HSA	Hollow stem auger
IC	Institutional controls
ID	Identification
IDW	Investigation-derived waste
IRP	Installation Restoration Program
IWMB	California Integrated Waste Management Board
LEA	Local enforcement agency
LFR	Levine-Fricke-Recon
LNAPL	Light nonaqueous phase liquid

ACRONYMS AND ABBREVIATIONS (Continued)

µg/L	Micrograms per liter
µmhos/cm	Micromhos per centimeter
MCPA	(4-chloro-2-methylphenoxy) acetic acid
MCPP	(4-chloro-2-methylphenoxy) propionic acid
mg/L	Milligrams per liter
MOA	Memorandum of agreement
MPE	Maximum probable earthquake
MS/MSD	Matrix spike/matrix spike duplicate
NBVCPH	Naval Base Ventura County Port Hueneme Site (formerly Naval Construction Battalion Center Port Hueneme)
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
NTU	Nephelometric turbidity units
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
P.E.	Professional engineer
PID	Photoionization detector
PMP	Postclosure Maintenance Plan
PPE	Personal protective equipment
ppm	Parts per million
PRC	PRC Environmental Management, Inc.
psf	Pounds per square foot
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
QAPP	Quality assurance project plan
R.G.	Registered geologist
RI	Remedial Investigation
RPD	Relative percent difference
RPM	Remedial project manager
RSIP	Regional Shore Infrastructure Plan
RWQCB	Regional Water Quality Control Board
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
SWDIV	Naval Facilities Engineering Command, Southwest Division
SWRCB	State Water Resources Control Board
TDS	Total dissolved solids
TEPP	Tetraethylpyrophosphate
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TPHE/P	Total petroleum hydrocarbons extractable/purgeable
TRPH	Total recoverable petroleum hydrocarbons
TtEMI	Tetra Tech EM Inc.

ACRONYMS AND ABBREVIATIONS (Continued)

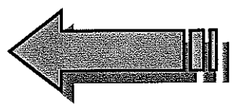
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VOA	Volatile organic analysis
VOC	Volatile organic compound
WBS	Work breakdown structure
WRS	Wilcoxon rank sum

READER'S GUIDE TO THE POSTCLOSURE MAINTENANCE PLAN

As an aid to the reader, each page of the postclosure maintenance plan (PMP) has been assembled with a large, left-hand margin for supplements to the text. These supplements correspond to nearby text and point out a key idea or element – there are informational statements, precautions, warnings, and photographs.

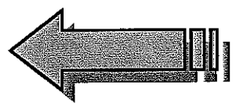
These supplements are not a shortcut to the full text and are not a comprehensive representation of the PMP. They are instead intended to call the reader's attention to important points that may be overlooked and improve his or her understanding of the site and maintenance tasks.

Information



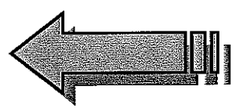
INFORMATIONAL STATEMENT
These boxes (white on black) point out important background information that pertains to the site and its maintenance.

Precaution



PRECAUTION
These boxes (yellow on black) indicate an item that, if overlooked, may result in a maintenance deficiency or cost the maintenance contractor extra time or money to make up or fix. They may also point out an important reporting requirement.

Warning



WARNING
These boxes (red on black) alert the reader of an element that, if overlooked, may result in an immediate deficiency in the integrity of the cover or a threat to human safety. They also point out some of the more costly duties of the contractor.

FOR FURTHER INFORMATION

The postclosure maintenance plan uses information and concepts from the California Code of Regulations The reader may wish to investigate these regulations as they pertain to postclosure maintenance. As an aide to the reader, the following table provides the relevant sections in the regulations for selected sections of the postclosure maintenance plan

PMP Section	Description	Section CCR Title 27
1.1	Purpose and Use of Plan	21825; 21830; 21769(c)(1)(B)
1.3	Regulatory Framework	20950[a][2][A][1]
	Final Postclosure Maintenance Plan Contents	21830
	PMP Review and Approval Schedules	21860
	Amendments to PMPs	21865(b)(3) and (4)
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2.6	Settlement Markers	20950
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3 2	Persons Responsible for Postclosure Inspection and Maintenance	21830(b)(2)
3.3	Tasks and Frequency	21180
3.4	Bookkeeping for the Maintenance Contractor	21180; 21710(a)(4)(C)
4.0	Final Cover Components Inspection, Maintenance, and Repair	21180; 21830; and 21090(c)
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4.6.1	Inspection	21090[3][2]; 21180[c]

PMP Section	Description	Section CCR Title 27
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6.0	Institutional Controls	21780[f]; 21180[c]
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6.2.2	Signage	20520
6.2.3	Site Access	21135
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6.2.5	NBVCPH Leasing, Closure, and Change of Ownership	21200
6.2.6	Financial Mechanisms	231769(a)(1); 21780(a)(3); 21865(b)(3); and 22205
7.0	Postclosure Land Use	21830; 21190; 21769(C)(2)(H); and 21190[c], [d]
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7.2	Land Use Types	21090[b][1][b]
7.2.2	Gas Control and Monitoring for Structures	20937
8.0	Emergency Response Plan	21130
8.2	Emergency Response Procedures	21130
9.0	Postclosure Maintenance Cost Opinion	21865[a][2], [b][1], [b][4]; and 21840[a][3]
Appendix C-01450	Construction Quality Assurance	20324[d]

1.0 INTRODUCTION

This section discusses the purpose and use of the Postclosure Maintenance Plan (PMP) for Site 14, provides a brief background of the site, describes regulatory framework of the PMP, and lists the authorization for its preparation.

Agency Involvement

The lead agency for this response action is the Navy. DTSC provides guidance and oversight on CERCLA activities undertaken at NBVC Port Hueneme.

1.1 PURPOSE AND USE OF PLAN

This PMP has been prepared to account for and prevent threats to public and environmental health associated with municipal solid waste landfills The Navy has conducted a removal action at the Site 14 landfill pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) In December 1997, the Navy signed the action memorandum in support of this action and the removal action began in August 1998. As described in the action memorandum, the removal action consisted of installing a cover on the landfill, introducing appropriate land use controls, and groundwater and gas monitoring

Primary ARARs

The primary ARARs affecting this action are the essential elements of 27 CCR that address landfill closure and postclosure maintenance.

The primary applicable or relevant and appropriate requirements (ARAR) identified in the action memorandum were the Title 14 and Title 23 California Code of Regulations (CCR) requirements for closing solid waste landfills Since the action memorandum was signed, the State of California consolidated these regulations into a new title, Title 27, and repealed the Title 14 and 23 regulations The Title 27 regulations became effective on July 18, 1997 The State's intent was to consolidate the regulations, without making substantive changes to them In this PMP, the Title 27 citations are provided This PMP has been prepared to ensure compliance with the substantive requirements of the Title 27 CCR ARARs relating to postclosure maintenance of the landfill cover and groundwater and gas monitoring of the landfill.

This PMP serves as the U S Department of the Navy's principal means to:

1 Provide information to support Navy development of a request for proposals and scope of work for award of a postclosure maintenance contract

2 Provide explicit instructions to the maintenance contractor for conducting and reporting on inspection, evaluation, and repair of the final cover

3 Provide the designer's requirements for and prohibitions against certain future land uses on the final cover

Site Size

Site 14 is 33 acres.

The site and buried trash before construction began

Chemicals of Concern

The chemicals of concern were identified as Aroclor-1260 (a polychlorinated biphenyl [PCB]), toxaphene (a pesticide), benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, chrysene (all polynuclear aromatic hydrocarbons [PAH]), and antimony (a metal).

Designer

The Engineers in Responsible Charge were Skip Dinges and Stephen Fisher of Tetra Tech EM Inc., (303) 295-1101.

1.2 SITE BACKGROUND

Installation Restoration Program (IRP) Site 14, the former Earthmoving Training Area, is a 33-acre site on the western perimeter of the Naval Base Ventura County Port Hueneme Site (NBVCPH) at Port Hueneme, California, that has historically been used for disposal of a variety of wastes During the 1950s and 1960s, 25 to 40 55-gallon drums that contained unknown chemicals were reportedly buried in trenches at the north-central portion of the site Wastes were discarded at Site 14 from as early as the 1950s and continuing into the 1980s. Discarded wastes included dredge spoils, transformer fluids, oily bilge water, lubricating oil, diesel fuel, gasoline, Stoddard solvent, trichloroethene, thinners, and rubbish. Pesticides and residues from burning may also have been disposed of on site The site has been shown to contain chemicals known to be hazardous to both human health and the environment. The COCs were identified as Aroclor-1260 (a polychlorinated biphenyl [PCB]), toxaphene (a pesticide), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, chrysene (all polynuclear aromatic hydrocarbons[PAH]), and antimony (a metal) These contaminants are present primarily in site soils at variable depths, although they have also been detected in samples of site groundwater

The Navy began investigating Site 14 in the mid-1980s under its Installation Restoration Program (IRP). As initial investigations indicated the potential for soil contamination, further evaluations were conducted pursuant to CERCLA Specifically, a site inspection (SI) was performed in 1988-89, followed by a remedial investigation (RI) in 1995 Because of the presence of PAHs in surface soil and the associated potential risks to human health, the Navy concluded a removal action was appropriate for the Site 14 landfill An engineering evaluation/cost analysis (EE/CA) was prepared in 1997 to evaluate various cleanup options for Site 14 In 1997, the Navy signed the action memorandum for Site 14, selecting a cover for the Site 14 landfill, groundwater and gas monitoring, and institutional controls as the removal action

Site 14 has been closed using an engineered alternative to the CERCLA presumptive remedy for municipal solid waste landfills The action memorandum presents the characterization basis for such a determination that includes risk to human health and the environment and the suspected age and contents of the landfill

The cover was constructed from 09/98 to 07/00

Constructors

The final cover was constructed by Baldi Brothers Constructors of Beaumont, California (909) 845-9521.

Rainfall

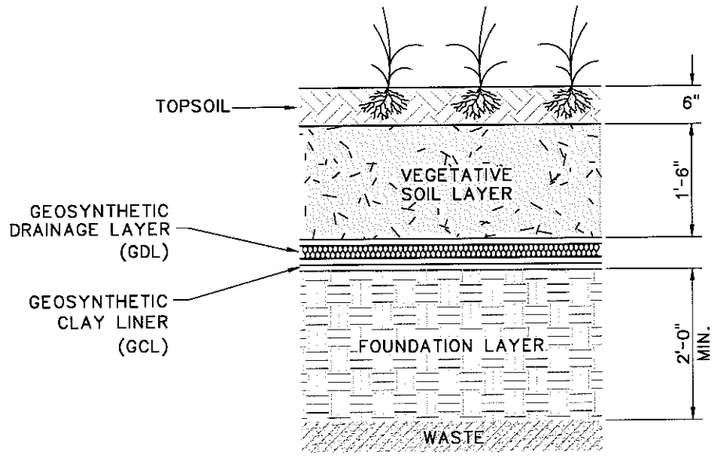
The design storm event was the 100-year, 24-hour event of 10.8 inches.

The final cover was constructed from September 1998 to July 2000 by Baldi Brothers Constructors of Beaumont, California, using existing soils as the foundation layer, a geosynthetic clay liner (GCL) as the low-permeability layer, a geosynthetic drainage layer (GDL) to provide subsurface drainage, and a vegetative soil layer (the drainage layer is not included in the stormwater detention area). Figure 1-1 shows the conceptual cross-section of cover construction. The cover was designed as a single mound, with drainage, and the ability to accommodate a wide range of future land uses The stormwater detention area (4 3 acres) was constructed to hold 13 acre feet of runoff, enough for the design storm event of 10 8 inches It also includes 1 acre for seasonal wetland mitigation

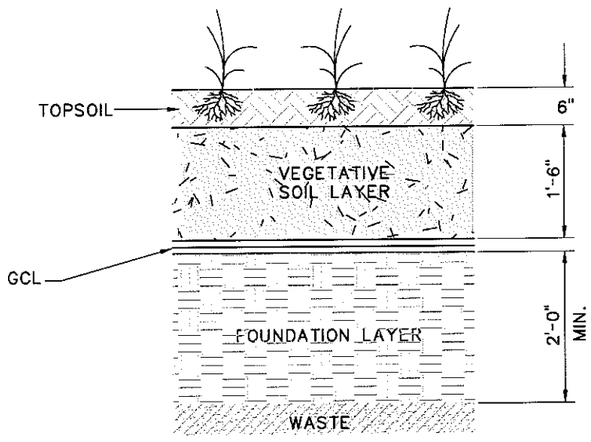
Runoff from approximately 5 acres is collected at the north sedimentation basin and is discharged to the stormwater channel immediately north of 23rd Avenue The remainder of the site is drained at the detention area outlet, which discharges to a local catch basin connected to the NBVCPH storm sewer.

1.3 REGULATORY FRAMEWORK

The Navy seeks concurrence from the California Department of Toxic Substances Control (DTSC), the California Regional Water Quality Control Board (RWQCB) Los Angeles Region, the California Integrated Waste Management Board (IWMB), and the local enforcement agency (LEA)



SITE 14 FINAL COVER CONFIGURATION EXCEPT DETENTION AREA SECTION (TYP.)



SITE 14 FINAL COVER CONFIGURATION IN DETENTION AREA SECTION (TYP.)

FIGURE 1-1
CONCEPTUAL CROSS-SECTION OF FINAL COVER CONSTRUCTION

The PMP entails a closure process of inspection, evaluation, maintenance, and bookkeeping over a minimum of 30 years (with an exception). The performance goal of the postclosure maintenance period is to minimize infiltration of water into the waste through maintenance of the cover's principal waste containment feature, the final cover (27 CCR 20950 [a][2][A][1]). The following CCR sections describe the closure process:

Postclosure Maintenance Period

The maintenance period is 30 years.

Final Postclosure Maintenance Plan Contents

The PMP provides a basis for the owner to establish an accurate cost estimate and methods for inspection, maintenance, and monitoring of the landfill during the postclosure maintenance period.

PMP Review and Comment

As explained in Section 1 2, the removal action for Site 14 has been completed Ongoing operation and maintenance will ensure that the action remains protective of human health and the environment. This PMP describes the activities to be undertaken during the operation and maintenance period

As with other documents prepared pursuant to CERCLA, the regulatory agencies have been given an opportunity to review and comment on the PMP. Any amendments to or revisions of the PMP will be handled as other CERCLA documents, with the agencies having an opportunity to review and comment

Funding

The PMP is amended when the financial mechanism funding the cover maintenance changes and when operation or design changes affect implementation of the PMP or the year of closure.

Amendments to PMPs

The PMP is amended when the financial mechanism funding the cover maintenance changes and when operation or design changes affect implementation of the PMP or the year of closure.

Site Conditions

Revisions are required when significant modifications to the PMP are needed to reflect changes in site conditions.

Revisions to PMPs

Revisions are required when significant modifications to the PMP are needed to reflect changes in site conditions Changes may include enhancing or reducing environmental control and increasing or decreasing the amount of funds required to implement the PMP

Release from Postclosure Maintenance

The owner may demonstrate to DTSC, RWQCB, IWMB, and the LEA that the landfill no longer poses a threat to public health and safety or the environment The owner may develop a clean-closure plan demonstrating that (1) the landfill material no longer poses a threat to water quality, and (2) all remaining containment features (including the final cover) of the landfill are either removed or treated to the extent that they no longer pose a threat to water quality.

Financial Responsibility for Postclosure Maintenance

The owner must demonstrate the availability of financial resources to conduct postclosure maintenance including submittal of the postclosure cost opinion, identification of mechanisms or combinations of mechanisms for funding, and related requirements The Navy's current financial resources for postclosure maintenance is included as Appendix A of this document.

1.4 PMP ORGANIZATION

This PMP is organized into nine sections and five appendices, as follows:

Section 1.0 Introduction

This section provides the history of the site, the purpose of the PMP, a brief description of the final cover, the regulatory framework, and authorization for the PMP

Section 2.0 As-Built Description of Monitoring and Control Systems

In this section, the final cover components are described in further detail and a maintenance elements map is included

Section 3.0 Maintenance Framework

Information regarding responsibilities, qualifications, and maintenance tasks is included in this section to facilitate the Navy and the maintenance contractor start and administer an effective and comprehensive contract

Section 4.0 Final Cover Components Inspection, Maintenance, and Repair

This section provides detailed procedures to maintain the final cover and track its performance. These are the maintenance contractor's instructions and represent, in part, the contract's statement of work.

Section 5.0 Groundwater Monitoring Plan

A brief overview of the main components of groundwater monitoring for the site is included here. The remainder of the plan is included as Appendix D

Section 6.0 Institutional Controls

Mechanisms employed by the final cover designer and the Navy for site security, ownership, finance, land use, and site access are discussed in this section.

Section 7.0 Postclosure Land Use

This section discusses future land use options and restrictions for the final cover

Section 8.0 Emergency Response Plan

In this section, a description of possible emergency situations and their responses is presented

Section 9.0 Postclosure Maintenance Cost Opinion

The Opinion of Probable Cost is used as a guide for Navy procurement of a maintenance contractor. This section gives the results of the cost analysis and Appendix E provides a detailed cost breakdown

References

All documents referenced in the PMP are included here

Appendix A Financial Resources for Postclosure Maintenance

This appendix is a Navy-drafted document demonstrating that it has the ability to and intention of paying landfill final cover maintenance costs for up to 30 years

Appendix B Full-Size Maintenance Elements Map

This map is the same as Figure 2-1 and facilitates performance of the contractor's maintenance duties

Repair

Appendix C contains the original construction specifications modified for use during repair of final cover components.

Appendix C Repair Specifications

This appendix contains the original construction specifications modified for use during repair of final cover components and serve as a guide for the maintenance contractor and the Navy to repair those components

Appendix D Groundwater Monitoring Plan

This appendix is a detailed and comprehensive monitoring plan

Costs

The cost opinion in Appendix E contains important cost assumptions.

Record Keeping

Forms 3-1 and 3-2 are the recommended method of record-keeping of contacts, responsible persons, inspections, repairs, and agency communication.

Inspections By Others

The Navy can allow inspection of the cover, data, record-keeping, and PMP at any time.

Appendix E Postclosure Maintenance Cost Opinion

This appendix includes a cost breakdown by task, backup calculation worksheets, assumptions affecting cost, and a present value analysis.

Index

The index refers to terms found in the PMP text and Appendix D only

Forms

These forms are to be used by the maintenance contractor and the Navy as photocopy masters of a recommended method of record-keeping of contacts, responsible persons, inspections, repairs, and agency communication

1.5 AUTHORIZATION

This PMP was authorized by Naval Facilities Engineering Command, Southwest Division (SWDIV) under contract task order 206 The task order was originally negotiated under Navy Engineering Field Activity West and Remedial Project Manager (RPM) Ronald Yee in December 1997
The current Navy RPM is Josh Fortenberry

2.0 AS-BUILT DESCRIPTION OF MONITORING AND CONTROL SYSTEMS

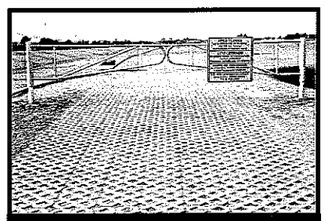
Monitoring and control systems at Site 14 are described in the following sections and shown on Figure 2-1. A full-size version of Figure 2-1 is included in Appendix B. Pertinent ARARs are identified in the following subheadings.

Perimeter Sign

2.1 SIGNAGE

The site is bounded at its perimeter by 13 signs that measure 12 by 18 inches at a height of approximately 6 feet. The perimeter signs are intended to be legible from a distance of 5 feet and to indicate that the area is closed. The signs are spaced approximately 400 feet apart, for a maximum sighting distance of 200 feet, and are in English and Spanish. The text of the perimeter sign reads:

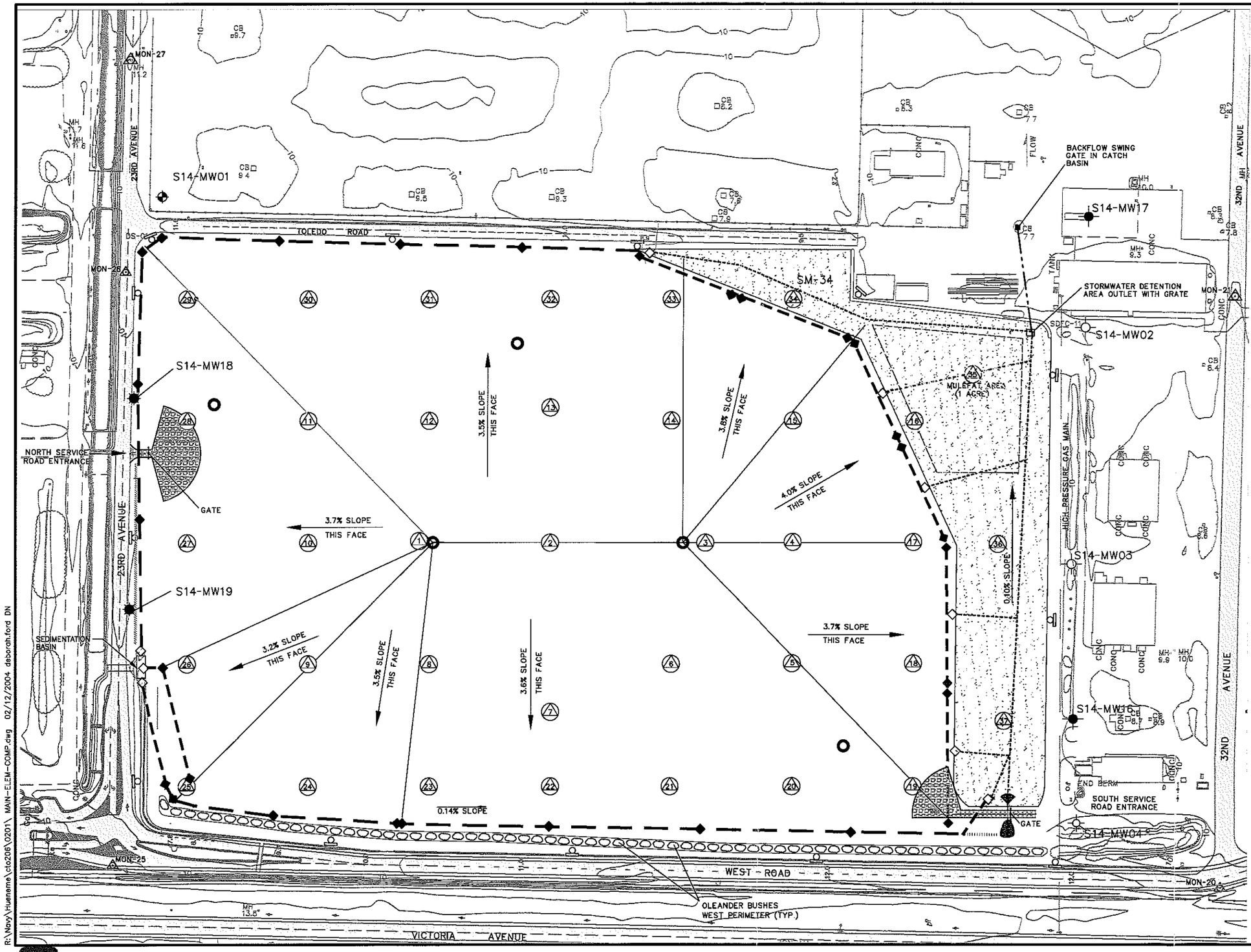
AREA CLOSED
NO EARTHMOVING OR DUMPING – RESTRICTED ACCESS
AUTHORIZED PERSONNEL ONLY



Gate and gate sign

Signs posted on entrance gates contain similar information, but also provide a contact telephone number to the NBVCPH public works office. The gate sign text reads:

AREA CLOSED
NO EARTHMOVING OR DUMPING
RESTRICTED ACCESS
AUTHORIZED PERSONNEL ONLY
OBSERVE AND AVOID EVIDENCE
OF PREVIOUS TRAFFIC ON GROUND
COVER TO MINIMIZE EROSION
FOR MORE INFORMATION CONTACT
BASE PUBLIC WORKS OFFICE
PHONE 982-4555



LEGEND

- SETTLEMENT MARKER (SM-16)
- PASSIVE GAS VENT
- CONTROL POINT (EXISTING MONUMENT)
- BUILDINGS
- VEGETATION
- PAVED ROADWAYS
- HIGH PRESURE GAS MAIN
- CMP STORM DRAIN PIPE
- SIGN (400' SPACING)
- NUISANCE WATER CHANNEL
- PROPOSED DETECTION MONITORING WELL
- EXISTING DETECTION MONITORING WELL
- EXISTING WELL PROTECTED FOR BACKGROUND MONITORING
- PROPOSED WELL FOR BACKGROUND MONITORING
- UNDERDRAIN CLEANOUT
- UNDERDRAIN OUTLET
- SURFACE DRAINAGE SWALE ONLY
- UNDERDRAIN ONLY
- SWALE OVER UNDERDRAIN
- STORMWATER DETENTION AREA (4 3 ACRES)

80' 0 80' 160'

SCALE: 1" = 160'

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FIGURE 2-1
MAINTENANCE ELEMENTS

Trespassing

If evidence of trespass is found, additional control measures are required (see Section 6.2.3).

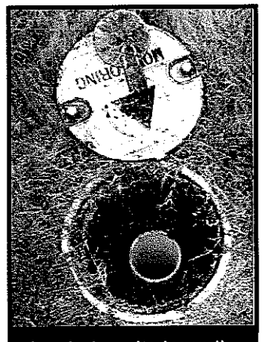
A gas vent

Gas Vents

Gas vents at the landfill cover ridge prevent gas build-up under the GCL. Remaining vents are located in areas where subsurface anomalies have been inferred by geotechnical analysis and may produce methanogenic gas later.

Monitoring Wells

Three wells are for background monitoring and five wells are for detection monitoring.



A typical monitoring well

2.2 SITE ACCESS

Although access to NBVCPH is restricted, this limitation is not considered adequate to control access to the landfill, and additional measures are provided The site includes both passive and active access controls. First, the perimeter of the site is formed into a swale that appears as an obvious boundary, although all swales are shallow enough to enable vehicle access Second, traffic is directed to two obvious entrances from 23rd Avenue on the north side, and from 32nd Avenue on the south side. These entrances to the cover have locked gates and include an area of semidurable pavement to prevent erosion The sign at the gate instructs drivers to avoid tracks left by previous traffic to prevent erosion

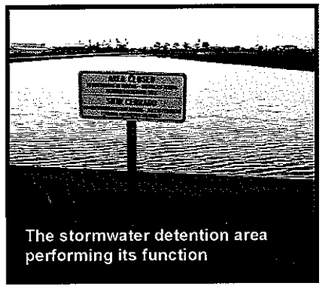
It is possible to bypass the gates and access the cover across the drainage swales If evidence of trespass is found, additional control measures are required (see Section 6 2 3)

2.3 GAS VENTS

Gas vents are designed to prevent gas build-up under the GCL that might otherwise cause a bubble and uplift Gas vents also mitigate the potential effects of rapid changes in barometric pressure or tidal fluctuations Vents at the landfill cover ridge prevent gas build-up under the GCL. Remaining vents are located in areas where subsurface anomalies have been inferred by geotechnical analysis and may produce methanogenic gas later Tests conducted before the cover was constructed indicated that subsurface gas concentrations in monitoring wells and ambient gas concentrations at the site boundary are below human health risk or flammability levels (Navy 1998)

2.4 GROUNDWATER MONITORING WELLS

Groundwater monitoring takes place via eight wells along the groundwater flow direction. Three wells are for background monitoring and five wells are for detection monitoring The wells are 4-inch polyvinyl chloride (PVC) casings installed in 8-inch boreholes Monitoring of constituents in the groundwater can be used to indicate whether contaminants in the foundation layer or refuse are leaching and, indirectly, as an indicator of GCL performance Since much of the refuse is suspected to lie below the water table, PMP groundwater data shall be used in conjunction with a NBVCPH-wide groundwater study to evaluate the source of groundwater contamination and the effectiveness of the cover.



The stormwater detention area performing its function

Drainage Limitation

The stormwater detention area meters flows from rainfall that exceeds the amount expected in the 10-year storm events the NBVCPH storm drain system was designed to accommodate.

Settlement

There are 37 markers on the cover.

A settlement marker

2.5 DRAINAGE

Approximately 4,320 linear feet of underdrain are located at the perimeter of the site The underdrains receive water from the GDL and carry it to several underdrain outlets at the north and south ends of the cover The GDL prevents the vegetative soil layer from becoming saturated and compromising slope stability

The north end of the cover drains to a sedimentation basin along with surface runoff directed by the perimeter swales The sedimentation basin drains through a culvert under 23rd Avenue to a drainage channel At the south end, approximately three-quarters of the total water from the cover surface and subsurface drains to the stormwater detention area and then to the NBVCPH storm drain system. The storm drainage capacity of the cover was designed for the 100-year, 24-hour storm event The stormwater detention area meters flows from rainfall that exceeds the amount expected in the 10-year storm events the NBVCPH storm drain system was designed to accommodate

2.6 SETTLEMENT MARKERS

There are 37 settlement markers installed on the cover on a grid of approximately 200 feet; some of the markers are over areas where subsurface anomalies were encountered in the geotechnical study The markers shall be used in conjunction with five control points at the perimeter of the site to monitor for differential settlement. Significant differential settlement can compromise the effectiveness of the GCL and may allow surface runoff to pond or erode the vegetative soil layer.

Responsibilities

The Navy is ultimately responsible for postclosure maintenance.

3.0 MAINTENANCE FRAMEWORK

The following sections summarize the elements of postclosure maintenance These elements include responsibilities, persons and organizations, major task areas, and major reporting requirements involved Pertinent ARARs are identified in the following subheadings

3.1 OWNER AND MAINTENANCE CONTRACTOR RESPONSIBILITIES

In cases where the Navy may contract certain maintenance functions to either internal or external organizations, a clear delineation of responsibilities is crucial to the success of the PMP Field inspection staff must be properly qualified Table 3-1 summarizes the maintenance tasks and staff qualifications The maintenance contractor must have relevant maintenance experience and staff with a certification in erosion (Certified Professional in Erosion and Sediment Control [CPESC]) administered by the Soil and Water Conservation Society Wildlife inspections must be performed by a degreed biologist with training in California Species of Special Concern

3.2 PERSONS RESPONSIBLE FOR POSTCLOSURE INSPECTION AND MAINTENANCE

Points of Contact

Form 3-1 must be kept up to date

Form 3-1 (found following the index) shall be used by the Navy and maintenance contractor to list personnel responsible for postclosure maintenance of the landfill and their address and telephone numbers The form must be updated as needed The form also identifies points of contact for emergency response

3.3 TASKS AND FREQUENCY

Maintenance Record

Form 3-2 must be kept up to date

Table 3-2 summarizes maintenance tasks and provides the rationale for their frequency. Form 3-2 (found following the index) lists inspection and maintenance tasks and their recommended frequency As with Form 3-1, the form is to be maintained up to date and must be used to record the date the task was completed, any comments, signatures, and any action required or completed

TABLE 3-1

TASK/QUALIFICATIONS BREAKDOWN

Task	Qualifications
Maintain Updated Postclosure Maintenance Plan	Authorized Navy Representative
Financial Responsibility	Authorized Navy Representative
Bookkeeping (See Table 3-2)	Authorized Navy Representative
Institutional Controls	
Site Security	NBVCPH Security; PMP Contractor
Signs and Gates	PMP Contractor
Site Access	PMP Contractor
Land Use	Authorized Navy Representative
Surveillance	PMP Contractor
Final Cover	
Vegetative Cover	CPESC or Civil P.E. (PMP Contractor)
Final Grading	CPESC or Civil P.E. (PMP Contractor)
Geosynthetic Clay Liner	R.G. or Civil P.E. (PMP Contractor)
Gas Vents	PMP Contractor
Groundwater Monitoring	R.G. or Civil P.E. (PMP Contractor)
Drainage	CPESC or Civil P.E. (PMP Contractor)
Surveying (Settlement Markers and Five-Yearly Iso–Settlement Map)	Civil P.E. (PMP Contractor) or Registered Land Surveyor
Emergency Response	PMP Contractor; NBVCPH Fire Department
Wildlife	Biologist with California Species of Special Concern proficiency

Note:

R.G. Registered Geologist
P.E. Professional Engineer
CPESC Certified Professional in Erosion and Sediment Control

TABLE 3-2

INSPECTION FREQUENCIES

Frequency	Maintenance Element	Rationale	PMP Section
Monthly	**Signs and Gates**		
	Inspect Operation	Possible frequency of unauthorized individuals or activities trespassing the site	4.2.1
Quarterly	**Vegetative Cover**		
	Inspect Vegetation	Vegetation is affected by seasonal changes in weather.	4.5.1
	Final Grading		
	Site Walk See Notes 1 and 7	Erosion, visible depressions, ponded water, odors, exposed refuse, cracks, settlement and subsidence, slope failure, and leachate seeps are possible within this timeframe.	4.6.1
	Wildlife		
	Search for Wildlife	Changes in wildlife most likely to occur on a seasonal basis.	4.7
	Gas		
	Inspect Vents See Note 1	after 27 CCR 20933	4.3.1
	Drainage		
	Inspect Erosion See Note 2	Erosion possible within this time frame. Significant wind and storm events shall be identified based on professional judgment of NBVCPH public works or environmental authorized personnel.	4.4.1
	Inspect for Trash, Blockage, and Condition	Potential accumulation or deterioration of drainage features is possible within this time frame	4.4.1
Annually	**Drainage**		
	Inspect Standing Water See Note 3	This condition likely to occur in the given timeframe.	4.4.1
	Soil Moisture Testing See Note 4	Highest soil moisture content of any concern is most likely late in the rainy season every year	4.4.1

TABLE 3-2 (Continued)

INSPECTION FREQUENCIES

Frequency	Maintenance Element	Rationale	PMP Section
5 Years	**Geosynthetic Clay Liner**		
	Periodic Leak Search See Note 5	Serves as periodic GCL leak test Long-term interval is needed to collect sufficient data for interpretation of groundwater monitoring data	4 1 1
	Final Grading		
	Surveying See Note 6	after 27 CCR 20190(e)	4 6.1
	Groundwater	**See Table D-2**	
1	**Collect Ambient Air Sample**	after 27 CCR 20933	4 3.1

Notes:

1 Soil gas monitoring will consist of separate soil gas surveys 6 months, 2 years, and once every 5 years after completion of the cover In addition to the stated frequency, inspections shall take place after a significant seismic event identified using the professional judgment of authorized NBVCPH environmental or public works personnel.
2 Inspection also required after significant wind and storm events
3 Inspection required after one 4-hour storm event
4 Inspection also required as baseline and annually after 4-hour or more storm event in February or March
5 Baseline data used in comparison with data from ongoing groundwater monitoring
6 Settlement monuments shall be surveyed once a year for the first 3 years. It is projected that by the third year there will be no evidence of significant settlement and little risk of excessive differential settlement. Initially, and every 5 years thereafter, aerial surveys shall be flown.
7 Final grading inspection on a quarterly basis includes survey monuments and access roads

3.4 BOOKKEEPING FOR THE MAINTENANCE CONTRACTOR

Although the Navy has planned for a 30-year postclosure maintenance period, CERCLA Section 121(c) only requires five-year reviews if hazardous substances remain on site after completion of the remedial action. The NCP, 40 CFR Section 300.430(f)(4)(ii), further elaborates on this requirement. It requires a review every five years if a remedial action is selected that results in hazardous substances remaining at the site above levels that allow for unlimited use and unrestricted exposure. Although Section 121(c) does not expressly address removal actions, EPA's Five-Year Review Guidance indicates that five year reviews should generally be conducted as a matter of policy when a removal action is conducted at an NPL site. Hazardous substances will remain on site above levels that allow for unlimited use and unrestricted exposure, and no remedial action has or will take place (EPA 2001). The guidance also contains EPA's expectation that federal agencies conduct five-year reviews as a matter of policy at sites that would be subject to policy reviews if they were on the NPL (EPA 2001).

Port Hueneme is not listed on the NPL. Because no remedial action is planned for Site 14, the Navy intends to conduct five-year reviews as a matter of policy for Site 14. As part of its five-year review, the Navy will address the substantive requirements in the Title 27 reporting regulations pertaining to post-closure monitoring and maintenance of the landfill.

Table 3-3 lists maintenance items to be tracked and the appropriate organization to receive the information.

Documents sent to DTSC should have all other regulatory agencies copied. All postclosure maintenance documentation and bookkeeping must be copied and kept at maintenance contractor offices, NBVCPH Environmental, and NBVCPH Public Works.

TABLE 3-3

BOOKKEEPING SUMMARY

Item	Supplemental Information (Title 27 CCR)	PMP Section	Recipients	Special Requirements
Five-yearly Iso-Settlement Map	21090(e)(2) 21180(c)	4 6 1	RWQCB, DTSC, IWMB	Professional engineer's signature for settlement area delineation
PMP Placed in Operating Record	21780(f)	6.0	DTSC, IWMB	None
	21130(a)	8.0	Navy	None
Results of Gas Survey	20934(a)	4.3.1	DTSC, IWMB	None
Change in Funding Mechanism	21865(b)(3) 21769(a)(1) 21780(a)(3) 22205	6 2 6	DTSC, IWMB	None
Land Use Changes	21190(c), (d)	7 0	DTSC, RWQCB, County of Ventura, IWMB	Professional engineer's signature for land use design
Emergency Response Plan Changes	21130(d)		DTSC, RWQCB, County of Ventura, IWMB	None
Cover Components Changes	21190(c)	4 0 / 7.0	DTSC, County of Ventura, IWMB	Professional engineer's signature for cover design
Maintenance Tasks Changes	21865(b)(1)	9 0	DTSC, IWMB	Professional engineer's signature for tasks
Year of Closure Change	21865(b)(2)	9.0	DTSC, IWMB	None
Cost of Maintenance Change	21840(a)(3); 21865(b)(4)	9 0	DTSC, IWMB	None
Title/Ownership Change	21630(a); 21200(b)	6 2 5	DTSC, IWMB	None
Wildlife Changes	--	4.7	DTSC, DFG	Degreed biologist signature

Notes:

CCR California Code of Regulations
DFG California Department of Fish and Game
DTSC California Department of Toxic Substances Control
IWMB California Integrated Waste Management Board
RWQCB Regional Water Quality Control Board
PMP Postclosure Maintenance Plan

All documents shall be accompanied by a cover letter addressed to DTSC with all other regulatory agencies copied

Reference Library

It is recommended that the maintenance contractor secure copies of all the listed documents for it's own use.

The PMP and supporting documents that may provide additional information useful for the landfill final cover operation and maintenance are listed below with their preferred storage location

Document	Storage Location:
1 Regional Shore Infrastructure Plan	PW Planning Code 320
2 Postclosure Maintenance Plan	PW Planning Code 320 PW Environmental Code 420
3 As-Built Construction Drawings	PW Engineering Code 210 PW Environmental Code 420
4 Design Basis Report	PW Environmental Code 420
5 Construction Specifications	PW Engineering Code 210 PW Environmental Code 420
6 Geotechnical Report	PW Environmental Code 420

It is recommended that the maintenance contractor secure copies of all the listed documents for its own use.

4.0 FINAL COVER COMPONENTS INSPECTION, MAINTENANCE, AND REPAIR

Inspections will occur at the frequency described on Form 3-2 under favorable conditions for each type of activity. Recording the inspection through forms, note taking, and photographs is recommended The following sections describe detailed inspection, maintenance, and repair procedures for each component of the cover. In general, any deficiencies that require repair must be corrected promptly to protect the integrity of the cover. Repairs shall be made in accordance with Appendix C Quality controls for maintenance and repair shall be developed by the maintenance contractor using Section 01450 of Appendix C; 27 CCR 21090(a)(4)(C); 21710(a)(5)(B); and 20324 as models

Quality Control

Quality controls for maintenance and repair shall be developed by the maintenance contractor using Section 01450 of Appendix C.

Inspection and maintenance may reveal the need for increased frequency of inspection or modified maintenance elements; these elements shall be noted on Form 3-2 as needed or amended Changes to components of the cover should follow the substantive requirements of 27 CCR 21890 and be concurred upon by DTSC, IWMB, the LEA, and RWQCB as part of the 5-year review.

Inspection and maintenance of the final cover may involve heavy equipment traffic In all cases, vehicular traffic shall be minimized, especially when soil is moist Under occasional circumstances, vehicles and heavy equipment do not pose a threat to the final cover (especially the vegetation) if care is taken to avoid damage Destroying vegetation, creating divots, or scarring the soil through concentrated traffic patterns, turning wheels or track without forward movement, high speeds, fast starts, and sharp cornering will result in erosion that may develop into an ongoing maintenance issue and must be avoided.

4.1 GEOSYNTHETIC CLAY LINER

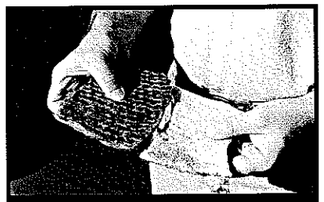
Excavation

Do not remove overburden above GCL.

Leak searches in the low-hydraulic-conductivity layer should be conducted periodically The leak search is performed using groundwater monitoring data

4.1.1 Inspection

Visual inspection of the GCL is not possible without excavation. The resulting loss of overburden destroys the strength properties of the GCL and so visual inspection is discouraged. GCL performance shall be evaluated conclusively through analysis of groundwater monitoring data.



A saturated GCL sample

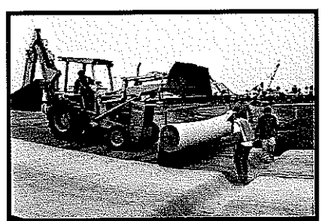
Data from initial groundwater samples collected as part of the groundwater monitoring plan shall be used as a baseline for comparison of data from ongoing groundwater monitoring at 5-year intervals. A registered civil engineer or geologist must use professional judgment in determining if any of the COCs listed in Section 1.2 are being added to the groundwater. The engineer or geologist must also take into account current data and information from NBVCPH-wide groundwater monitoring studies. If data indicate failure of the GCL as a low-hydraulic-conductivity layer, further tests shall be required. In this case, a registered civil engineer or geologist must devise a sampling and analysis plan that may include soil moisture probing or additional groundwater monitoring wells to isolate as most practicable the location of the failing GCL. The failed GCL section must be repaired according to Section 4.1.3.

Leakage

The periodic leak search is performed using groundwater monitoring data.

4.1.2 Maintenance

The GCL requires no scheduled maintenance but must be inspected after events or activities that may damage it such as penetrations, incorrect probing, overexcavation, and settlement.



GCL during installation

4.1.3 Repair

The GCL shall be repaired if necessary in accordance with Appendix C and 27 CCR 21090. The overlying GDL may be re-installed, but a new piece of GCL must be used to cover the foundation layer immediately.

4.2 SIGNS AND GATES

Signs and gates represent the primary means of site security.

A perimeter sign

4.2.1 Inspection

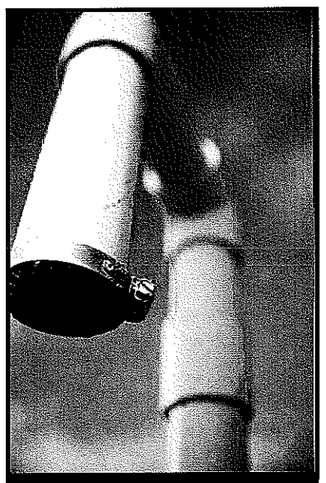
Signs shall be inspected monthly for presence, legibility, vandalism, or other inadequacies The effectiveness of the signs in restricting access to site shall be evaluated Damage to the locks, gates, and signs could result from weathering or vandalism If locks have rusted and do not function properly, they shall be replaced.

4.2.2 Maintenance

Signs typically require no maintenance However, if legibility is impaired at a distance of 5 feet as a result of dirt or faded colors, the sign must be cleaned or replaced in accordance with Appendix C and construction drawings Gate locks and latches shall be maintained in proper operating condition.

4.2.3 Repair

Sign and lock replacement is recommended in place of repair and shall be carried out as necessary to restore the legibility of the sign or the security of the gates. Replacement and repair shall be made in accordance with Appendix C and as-built construction drawings.


A gas vent and screen

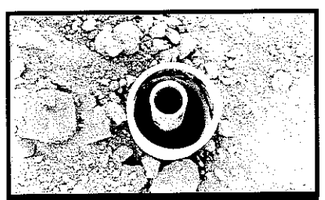
4.3 GAS VENTS

Gas vents prevent gas from becoming trapped under the GCL and are located in areas where gas generation or accumulation is most likely Except for the vents at the landfill cover ridge, the vents are located in areas where subsurface anomalies have been inferred by geotechnical analysis and may produce methanogenic gas However, tests before the cover was constructed (Navy 1998) indicated that subsurface gas concentrations in gas monitoring wells and ambient gas concentrations at the site boundary are low and in all cases were below human health risk or flammability levels

4.3.1 Inspection

Vents shall be visually inspected for structural integrity and general condition once every quarter. The vent must be firmly seated and the opening must be unobstructed. The effectiveness and condition of rocks placed to protect the vents must be noted, along with any problem with wildlife activity that obstructs the opening (for example, burrowing or nesting). In addition to the stated frequency, inspections shall take place after a significant seismic event as identified by the professional judgment of authorized NBVCPH environmental or public works personnel

The substantive requirements of 27 CCR 20933 have been relaxed based on 27 CCR 20918 and previous final cover design reviews. A letter of IWMB concurrence on this is found in Appendix F. However, as a precautionary measure, air shall be analyzed for presence of methane gas at the perimeter of the site downwind of the vents using a photoionization detector (PID) 6 months, 2 years, and every 5 years after completion of the cover. If site land use includes inhabited areas or structures, a second sample shall be collected at the boundary of the land use or inside the structure. The sample shall contain less than 5 percent methane by volume in air at the property boundary, and less than 1.5 percent methane by volume in air inside structures. Values exceeding these amounts will be addressed as part of the 5-year review under CERCLA, or more frequently if site conditions pose a risk to human health or the environment.



A gas vent during installation

4.3.2 Maintenance

Any obstructions must be removed and cracked pipe replaced. Vents that are not firmly seated are most likely broken below the surface and must be repaired. Rocks that have been hit or moved shall be replaced in accordance with the construction drawings. Damaged or missing vent screens shall also be replaced

4.3.3 Repair

Broken Vents

Because the purpose of the gas vents is to release gas, the criterion for repair of broken or damaged pipe is the likelihood that water or burrowing animals will enter the vent or penetrate the GCL

The vent shall be repaired when a pipe is broken. Because the purpose of the gas vents is to release gas, the criterion for repair of broken or damaged pipe is the likelihood that water or burrowing animals will enter the vent or penetrate the GCL. A loose or damaged pipe must be excavated to the broken section and repaired in accordance with Appendix C. Breaks below the GCL shall also be repaired in accordance with Appendix C for the GCL.

4.4 DRAINAGE FEATURES

Drainage features consist of the GDL, culverts, swales, underdrains, and outlets.

4.4.1 Inspection

Standing Water

A registered civil engineer or CPESC must investigate the cause of standing water and document a remedy.

Immediately after at least one 4-hour storm event per year, a site walk must be conducted to inspect for evidence of standing water on the cover face, swales, culverts, and outlets. Standing water in the detention area is acceptable but must be addressed and repaired immediately at any other location.

A registered civil engineer or CPESC must investigate the cause of standing water and document a remedy.

Erosion

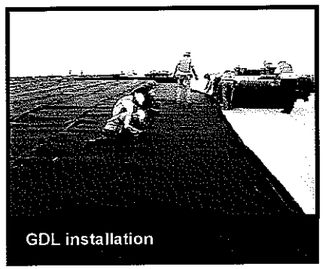
On a quarterly basis, a site walk shall be conducted to check for the formation of rills or gullies on the cover face, swales, berms, drainage structures, rip-rap, and detention area. The cover must be checked for exposed erosion control fabric.

Excavation

Do not remove overburden above GDL.

Trash, Blockage, and Condition

On a quarterly basis, surface drainage features shall be inspected for trash or other blockage. This inspection shall encompass outlets, screens, racks, culverts, rip-rap, and swales. Catch basins, culverts, and outlets that are hydraulically connected to the cover shall also be inspected. Underdrain cleanout caps must be checked for proper fit and correct installation.

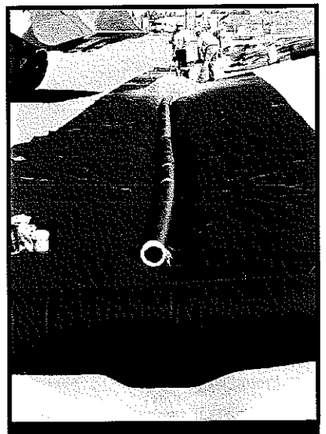

GDL installation

Probing

Do not puncture GCL with probe

Wet Soil

The cause of the problem must be identified and addressed by a registered civil engineer or CPESC


Underdrain installation

Geosynthetic Drainage Layer

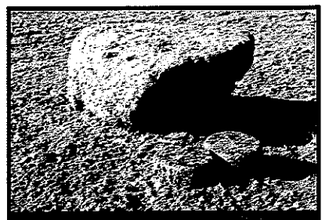
Visual inspection of the GDL is not possible without excavation However, the resulting loss of overburden destroys the strength properties of the GCL and visual inspection is discouraged

Once every year, GDL performance must be checked using a portable tensiometer or soil moisture probe The probe must be calibrated to percent field capacity for the soil at each location, take into account temperature, water dissolved solids content, and give electroconductivity readings To test the GDL performance, select a location between 4 and 12 feet upgradient from the toe of slope or the underdrain, not more than 200 feet from an underdrain outlet If future land use includes additional fixed loads to the cover, an additional inspection point on the downgradient side of the load must be included The probe must be inserted to within 1 inch of the drainage layer

An acceptable soil moisture condition is anything less than field capacity The maintenance contractor shall be responsible to explain changes in measurements, taking into account equipment used, electroconductivity, variations in soil type, and any other parameter affecting measurements Soil moisture results that indicate a condition above field capacity shall require further investigation or reclassification of the effected area to a lower land use in which failure of soils is not critical to cost or human safety The Navy may also elect to remove and re-install the defective sections The cause of the problem must be identified and addressed by a registered civil engineer or CPESC

Underdrain Condition

A tensiometer such as the one described above shall be used at each of the nine underdrain outlets to measure moisture content in the soil once per year or immediately after a storm event of duration greater than 4 hours in February or March These months are ideal because they are at the end of the rainy season The measurement location shall be between 4 and 12 feet upgradient from the toe of slope or the underdrain, but not more than 200 feet from an underdrain outlet Measurements shall be taken immediately above the GDL Results that indicate a soil condition of less than field capacity are acceptable



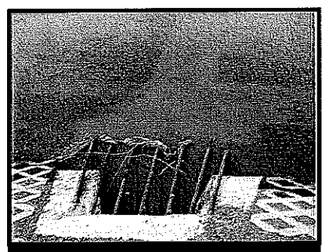
Underdrain cleanouts

Inspection Frequency

The frequency of inspection by tensiometer must be increased to account for the poor drainage

Impeding Flows

Tall vegetation in swales or in front of outlets reduces required flow capacity



The stormwater detention area must be kept clear of blockages

Vegetation

Vegetative cover limits:

- **Wind erosion**
- **Water erosion**
- **Instability**
- **Infiltration of water**

In case soil is saturated, internal videotaping of the underdrains in the vicinity of the tensiometer measurements is required. If video results indicate underdrain perforations are clogged, the underdrains must be cleaned by water jet. Cleaning is most easily accomplished through the use of well screen cleaning and redevelopment equipment. The frequency of inspection by tensiometer must be increased to account for the poor drainage.

If video results show that perforations are clean and clear, sections of the GDL where saturated soil was found must be excavated and inspected for the cause of poor drainage. The excavation shall require replacement of underlying GCL and shall be repaired according to Section 4.4.3. Appropriate measures must then be taken to restore soil to an adequately drained condition.

4.4.2 Maintenance

Culverts, swales, outlets, outlet screens or racks, sedimentation basin, catch basins, and the detention area shall be cleaned of sediments and trash on an as-needed basis. Outlet screens must be replaced as necessary. The inspector must also verify that all underdrain cleanouts are capped correctly. Vegetation in swales must be maintained at a height between 2 and 8 inches.

4.4.3 Repair

Deficiencies, damage, and failure of the drainage system shall be repaired and restored immediately. Any component of the drainage system that requires replacement or repair must be accompanied by replacement of underlying GCL when overburden is removed and installed in accordance with Appendix C.

4.5 VEGETATIVE COVER

Vegetative cover protects the surface from wind and water erosion, improves the stability of the slopes, ensures the integrity of the final cover, improves visual aesthetics, and limits infiltration of surface water.

4.5.1 Inspection

Vegetative cover shall be inspected on a quarterly basis for signs of stress, stunted growth, wilting, color changes, and bare spots. Areas of significantly healthier or more sickly growth shall be noted, as well as the dominance of a particular plant species. Check for percent bare area. The condition of vegetation within paving stone must be noted. In the detention area, plant density and size in a 100-foot radius from the outlet must be noted.

Erosion Control

The vegetative cover shall be evaluated for species suitability by noting the overall effectiveness in erosion control.

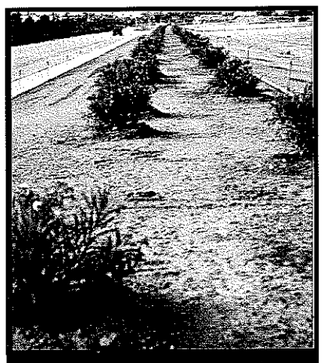
At each inspection, the vegetative cover shall be evaluated for species suitability by noting the overall effectiveness in erosion control. Chronic deficiencies in planted species require selecting and planting species that are better adapted to the environment. This evaluation shall be done on an as-needed basis under consultation with the California Department of Fish and Game (DFG) when the suitability of a species is in question.

4.5.2 Maintenance

Impeding Flows

The detention area outlet requires unobstructed flow within a 100-foot radius.

Bare spots shall not exceed 2 percent of the total cover area and 30 percent of any individual 100-square-foot area. These areas must be reseeded or planted according to Appendix C. An area is considered bare if healthy vegetation is not covering the soil. Cutting or mowing vegetation must occur when it would promote a healthier stand of vegetation or when desired to prevent creation of wildlife habitat. Vegetation should not require irrigation once established because it is of drought-tolerant varieties. Loss of vegetation caused by lack of water is a trigger to consider establishment or re-establishment of drought-tolerant plant species.



Oleanders provide an aesthetic visual barrier from observers to the west

Thinning, mowing, or pruning in the detention area may be desirable for aesthetic reasons but is required for unobstructed water flow within a 100-foot radius of the outlet. In this area, a maximum density of 20 plants per square foot and a maximum plant height of 18 inches must be maintained.

Poisonous Plants

All parts of the Oleander are poisonous if ingested

Oleanders or any other shrub or tree on the west berm may be pruned to promote high or low density or a more bushy or tree-like appearance, as desired There is no requirement for bushes or trees on the berm except for aesthetic reasons desired by the Navy during the landfill cover design phase. For Oleander, prune in winter or spring and pull out suckers that appear at base of plant All parts of the plant are poisonous Gloves are recommended and burning cuttings is discouraged Yellowing and dropping of old leaves is a sign of drought stress, but yellowing of new leaves can indicate overwatering

4.5.3 Repair

Irrigation was necessary to establish vegetation

Damage to vegetation shall be repaired immediately in accordance with the vegetation specification in Appendix C. Irrigation during the establishment period must be provided, if needed. When damage includes significant loss of soil or excavation resulting in loss of GCL overburden in an area of larger than 1 square foot, the GCL shall be replaced as described in Section 4 1.

4.6 FINAL GRADING

The uniformity of grade helps prevent erosion on the cover and to reduce water infiltration through the cover The cover's sloped faces must be maintained to avoid the following:

Bare spots are an erosion threat; they must be repaired and their cause addressed

- Evidence of erosion
- Visible depressions
- Ponded water
- Odor
- Exposed refuse
- Cracks
- Settlement and subsidence
- Slope failure
- Leachate seeps

4.6.1 Inspection

Settlement monuments shall be surveyed once a year for the first 3 years. It is projected that by the third year there will be no evidence of significant settlement and little risk of excessive differential settlement

Surveying

Initially and every 5 years thereafter aerial surveys shall be flown

Initially and every 5 years thereafter as part of the CERCLA 5-year reviews aerial surveys will be conducted. Areas on any cover face not showing smooth surfaces shall be surveyed using the installed settlement markers as verification and determination of significant differential settlement. Iso-settlement maps shall also be produced to calculate any differential settlement. The maps shall be produced with a maximum contour interval of 1 foot and a scale of 1 inch equals 80 feet. Settlement markers shall also be referenced to surrounding benchmarks (as described in the construction drawings), and elevations shall be measured. The findings of the survey and delineation of the settlement area shall be signed by a professional engineer and will be included in the 5-year review report

Differential Settlement

Damage to the GCL can result when one area settles more than an adjacent area

Excessive differential settlement determined through the use of settlement markers and slope analysis is defined as slopes exceeding 4 percent relative to a maximum distance set by the aerial survey contour interval or settlement marker interval. Excessive differential settlement produces strain in the GCL beyond the manufacturer's warranty

Walking Distance

A complete site walk traverses 5.5 miles

The entire cover surface shall be walked on paths 50 feet apart, resulting in an inspection walk of approximately 5.5 miles. The cover shall be visually inspected for factors listed above on a quarterly basis, noting especially where differential settlement may cause ponding. Questionable areas must be determined to have no negative slope resulting in ponding either by applying water or surveying. Findings and observations shall be reported using a full-scale, 1 inch equals 80 feet map of the final cover. In addition to the stated frequency, inspections shall take place after a significant seismic event determined by the professional judgment of authorized NBVCPH environmental or public works personnel

4.6.2 Maintenance

Slope

The minimum slope on the cover (except detention pond) is 3 percent

The final grading requires no maintenance provided there are no significant environmental effects or settlement. The final grade shall be maintained at a minimum slope of 3 percent

5.0 GROUNDWATER MONITORING PLAN

This section introduces the groundwater monitoring standards and presents a conceptual model of the site and monitoring network, including the regulatory framework and rationale. Appendix D describes the detailed development of a monitoring plan including sampling constituents, monitoring points, concentration limits, the sampling and analysis plan, data evaluation (statistical methods), and reporting requirements

Monitoring Wells

Monitoring wells were not part of the original cover design because a NBVCPH-wide groundwater monitoring study was considered adequate to address groundwater monitoring at the site.

The monitoring plan includes specifications and guidelines for monitoring well installation. Monitoring wells were not part of the original cover design because a NBVCPH-wide groundwater monitoring study was considered adequate to address groundwater monitoring at the site. However, the NBVCPH-wide groundwater monitoring study was later deemed by regulatory agencies as not sufficient to meet the groundwater monitoring requirements for closed landfills. There are eight monitoring wells for IRP Site 14. Four new monitoring wells were installed in new locations in 2002. Also in 2002, three existing monitoring wells were redrilled and reinstalled in-place.

5.1 REGULATORY FRAMEWORK

The ARARs for groundwater monitoring at Site 14 are found in CCR Title 27. Specifically, the following regulations have been identified as ARARs:

- 27 CCR 20415(b)(1)(B): monitoring point and background monitoring point requirements
- 27 CCR 20415(e): general monitoring requirements (such as boring log requirements, QA/QC, and data analysis methods)
- 27 CCR 20420: detection monitoring program standards

4.6.3 Repair

Fixing the Slope

- Check if it exceeds limit
- Restore grade
- Address cause of differential settlement

If differential settlement is discovered through the use of settlement markers or the aerial survey slope analysis, and exceeds 4 percent, or falls less than 3 percent, relative to a maximum distance set by the aerial survey contour interval or settlement marker interval, the grade must be restored to a minimum slope of 3 percent and a maximum slope of 4 percent. Deficiencies, damage, and failure of the final grading shall immediately be repaired and restored to design conditions in accordance with Appendix C. Temporary repairs may be made until permanent repairs can be scheduled. A professional engineer shall evaluate the cause and recommend a remedy to avoid future occurrences if possible.

Habitats

One acre is designated for seasonal wetland mitigation. All other areas are not habitat.

Cracks in the final cover shall be sealed with similar soil. Any erosion damage that results from extremely heavy rainfall shall be repaired. Temporary berms, ditches, and straw mulch shall be used to prevent further erosion damage to soil cover areas until site conditions permit re-establishment of final cover and reseeding of vegetation. These activities shall be carried out in accordance with Appendix C

A pair of burrowing owls

4.7 WILDLIFE

The former earthmoving training area was a potential habitat for burrowing owls (*Speotyto cunicularia*) and other California Species of Special Concern. A seasonal wetland plant species known as mulefat (*Baccharis salicifolia*) was present as well. Before construction of the cover began, no species of concern were found except for mulefat. Destruction of mulefat by construction of the final cover was mitigated by planting it in the detention area.

Mulefat (*Baccharis salicifolia*)

Wildlife surveys must be conducted at the same time as the final grading walk. Personnel assigned to the walk must be familiar with all the current California Species of Special Concern for easy identification. Discovery of any animals or plant species other than those planted during construction of the final cover will be reported to DFG and copied to DTSC as specified in Table 3-3

5.2 MONITORING RATIONALE AND CONCEPTUAL MODEL OF SITE

This section presents the site-specific rationale for postclosure monitoring and describes the conceptual model of Site 14 as it pertains to general monitoring approaches. The monitoring rationale presented in Section 5.2.1 discusses the characteristics of the site that require postclosure groundwater monitoring. The conceptual model, as described in Section 5.2.2, draws on geologic, hydrogeologic, and investigative results presented in the remedial investigation (RI) report (PRC 1997). Section D.1.1 (Appendix D) presents the COCs in accordance with information derived from the RI report.

5.2.1 Monitoring Rationale

Groundwater contamination within the semiperched aquifer at Site 14 was characterized through environmental investigations that culminated in the RI (PRC 1997). Further characterization is not necessary; however, postclosure monitoring is required to confirm that contamination in groundwater does not migrate off site, potentially endangering human and ecological receptors. Contaminated soil at Site 14 has not been shown to have a direct correlation with contaminants detected in groundwater at or immediately downgradient of the site (PRC 1997), indicating that activities at Site 14 may not have contributed to groundwater contamination and that soil contaminants may not be a source of groundwater contamination. Nevertheless, PMP groundwater data shall be used in conjunction with a NBVCPH-wide groundwater study to detect and evaluate the source of contamination in groundwater. Data that show contaminant levels are decreasing may indicate that the final cover is effective.

Contamination

Soil contaminants may not be a source of groundwater contamination.

The goal of the groundwater monitoring plan for Site 14 is to design a monitoring network within the semiperched aquifer to facilitate monitoring of contaminants that could migrate off site. The proposed postclosure groundwater monitoring system for Site 14 consists of three upgradient monitoring wells (one of which is existing) to provide background data for groundwater not affected by the site and five downgradient detection wells (three of which are existing) to monitor groundwater exiting the site. The upgradient wells provide a baseline for monitoring at the downgradient wells, where potentially contaminated groundwater from Site 14 would be detected.

GCL Performance

Groundwater monitoring is used to perform the GCL periodic leak search.

5.2.2 Conceptual Site Model

The development of a conceptual site model for Site 14 entailed a review of geologic, hydrogeologic, and investigative information presented in the RI report The conceptual model depicted in Figure 5-1 incorporates (1) geologic and hydrogeologic information from the RI report, including near-surface geology, semiperched aquifer hydrogeology, and groundwater recharge and discharge areas at Site 14; (2) elements of the Site 14 landfill cover; and (3) elements of the groundwater monitoring network

As interpreted from the Site 14 boring logs and geotechnical results, the area is underlain by unconsolidated sands, silts, and clays A silty-sand interval was generally encountered from the ground surface to approximately 14 feet below ground surface (bgs) The thickness of the silty-sand interval was observed to vary with the surface topography and now varies with the sub-cover topography created by construction of the landfill cover (Figure 5-1)

Portions of this interval contain thin beds of silt, clay, or clayey sand Beneath this interval is a fine- to coarse-grained sand unit that is occasionally silty or, in some instances, contains clay layers A silty clay unit is present beneath the sand unit This clay was encountered at depths ranging from 23 to 30 feet bgs

Trash

Trash is believed to be submerged below the water table.

Water level measurements recorded during the RI indicate that groundwater flow within the semiperched aquifer is tidally affected at Site 14, with the largest effect noted in the western portion of the site (PRC 1997) Directions and gradients of groundwater flow at Site 14 vary as a result of tidal effects; however, mean groundwater flow direction was qualitatively interpreted to be to the southwest in the northern portion of the site, changing to a southerly to southeasterly direction in the southern portion at a maximum gradient of 0 0008 feet per feet (ft/ft) (PRC 1997). Water level data collected in 1997 and 1998 during a basewide groundwater investigation indicate that seasonal high water table conditions prevail in late winter and that low water table conditions occur in mid-autumn (Table 5-1) Hydraulic conductivity at Site 14, as measured through slug testing, averages 3 x 10^{-3} centimeters per second (cm/sec), or 5 92 x 10^{-3} feet per minute (ft/min) Assuming an effective porosity for fine sand of 21 percent (USGS 1967) and using average hydraulic conductivity, groundwater velocity averages approximately 0 032 feet/day (ft/day)

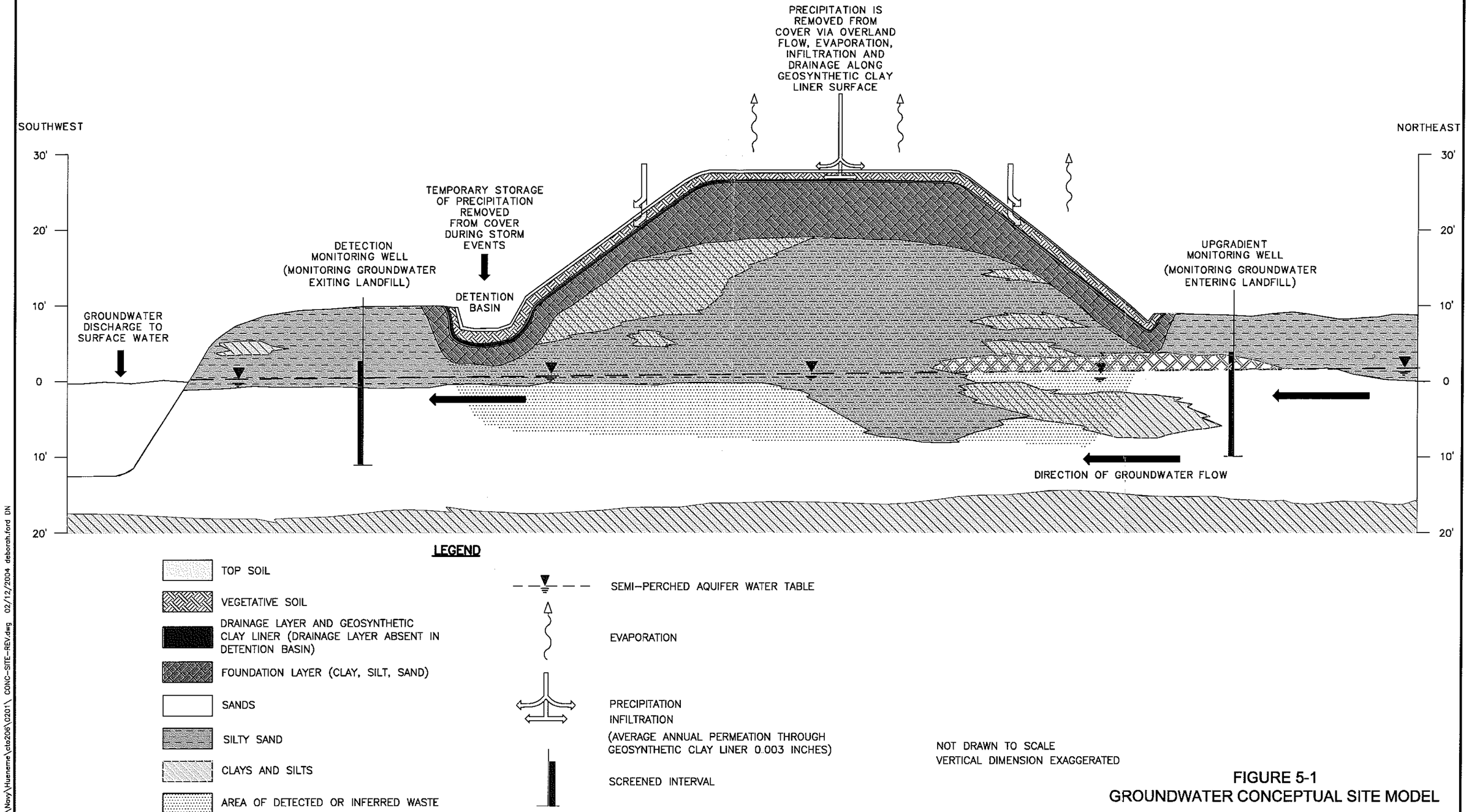


FIGURE 5-1
GROUNDWATER CONCEPTUAL SITE MODEL

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TABLE 5-1

WATER LEVEL DATA

Location	Quarter	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Corrected Groundwater Elevation	Comments
S14MW01	2	7.74	--	--		Inaccessible
S14MW01	3	7.74	6.18	1.56		
S14MW01	4	7.74	6.17	1.57		
S14MW02	2	4.2	3.86	0.34	0.56	
S14MW02	3	4.2	3.12	1.08		
S14MW02	4	4.2	2.56	1.64		
S14MW03	1	7.44	6.88	0.56	1.20	
S14MW03	2	7.44	7.08	0.36	0.92	
S14MW03	3	7.44	--	--		Inaccessible
S14MW03	4	7.44	5.86	1.58	2.24	
S14MW04	1	7.3	6.65	0.65	0.96	
S14MW04	2	7.3	6.70	0.60	0.90	
S14MW04	3	7.3	5.72	1.58	1.77	
S14MW04	4	7.3	4.33	2.97		
S14MW05	2	13.64	12.88	0.76	0.82	
S14MW05	3	13.64	12.19	1.45		
S14MW05	4	13.64	12.11	1.53		
S14MW06R	2	14.27	13.48	0.79		
S14MW06R	3	14.27	12.76	1.51		
S14MW06R	4	14.27	12.95	1.32		
S14MW07	2	5.09	4.15	0.94		
S14MW07	3	5.09	3.67	1.42		
S14MW07	4	5.09	3.67	1.42		
S14MW08	2	7.58	6.61	0.97	1.05	
S14MW08	3	7.58	6.28	1.30	1.37	
S14MW08	4	7.58	6.05	1.53	1.62	
S14MW09	2	6.75	6.14	0.61	1.04	
S14MW09	3	6.75	5.68	1.07	1.14	
S14MW09	4	6.75	5.28	1.47	1.86	
S14MW10	2	14.84	13.92	0.92	1.03	

Location	Quarter	Top of Casing Elevation	Depth to Water	Groundwater Elevation	Corrected Groundwater Elevation	Comments
S14MW10	3	14.84	13.42	1.42		
S14MW10	4	14.84	13.12	1.72		
S14MW11	2	15.81	14.85	0.96		
S14MW11	3	15.81	14.33	1.48		
S14MW11	4	15.81	14.08	1.73		
S14MW12	2	15.7	14.91	0.79	1.44	
S14MW12	3	15.7	14.41	1.29	2.02	
S14MW12	4	15.7	14.16	1.54		
S14MW13	1	12.97	12.05	0.92	0.96	
S14MW13	2	12.97	12.22	0.75		
S14MW13	3	12.97	11.43	1.54		
S14MW13	4	12.97	10.44	2.53		
S14MW14	1	10.23	9.52	0.71		
S14MW14	2	10.23	9.69	0.54		
S14MW14	3	10.23	9.02	1.21	1.23	
S14MW14	4	10.23	8.66	1.57		
S14MW15	1	10.31	9.65	0.66	1.30	
S14MW15	2	10.31	9.80	0.51	1.09	
S14MW15	3	10.31	9.18	1.13	1.76	
S14MW15	4	10.31	8.80	1.51	2.20	

Notes:

Synoptic water levels were collected as follows:

First Quarter: Water levels were collected May 6, 1997, between 13:30 and 16:25. High tide was at 10:11; low tide was at 15:41.

Second Quarter: Water levels were collected October 13, 1997, between 14:00 and 18:20. Low tide was at 14:11; high tide was at 20:11.

Third Quarter: Water levels were collected January 13, 1998, between 7:50 and 17:00. High tide was at 9:11; low tide was at 16:19.

Fourth Quarter: Water levels were collected March 31, 1998, between 11:00 and 18:20. High tide was at 12:11; low tide was at 17:37.

Groundwater elevations were corrected to account for density differences if total dissolved solids exceeded 10,000 milligrams per liter.

Recharge areas for groundwater within the semiperched aquifer at Site 14 are primarily upgradient, off-base, and regional. Upgradient, crossgradient, and downgradient areas within NBVCPH constitute lesser recharge areas. Upgradient recharge areas within NBVCPH include unpaved areas where meteoric waters percolate through the vadose zone to the semiperched aquifer and, possibly, storm water ditches that may contribute minor quantities of recharge. Net recharge by percolating precipitation is considered negligible during average rainfall conditions, but likely occurs during heavy rainfall and when total rainfall exceeds the average annual value (PRC 1997). Crossgradient and downgradient recharge to groundwater beneath Site 14 may result from temporal changes in groundwater gradient created by tidal effects. Recharge at Site 14 via percolating precipitation is inhibited by the landfill cover, and essentially eliminates the possibility that contaminants present in the vadose zone beneath Site 14 would leach to the semiperched aquifer.

Monitoring Data

Groundwater monitoring data exists for points basewide.

The direction of mean groundwater flow beneath Site 14 indicates that groundwater within the semiperched aquifer from the site discharges to either surface water ditches within NBVCPH, Channel Islands Harbor, to Hueneme Harbor, or to the Pacific Ocean.

The RI report (PRC 1997) identified wind, infiltration and percolation, overland surface water flow, and leaching as the primary release mechanisms for contaminants at Site 14. The RI report also identified air, soil, groundwater, surface water, and sediment in adjacent surface water ditches as the migration pathways for Site 14 contaminants. The landfill cover at Site 14 effectively eliminates or reduces the release mechanisms of contaminated soils, resulting in incomplete migration pathways. The cover was constructed to eliminate the possibility that contamination in surface soils would migrate via windblown particulates or surface transport by water to potential receptors. The landfill cover also inhibits infiltration of meteoric waters through the vadose zone to groundwater, providing a 99.8 percent reduction in infiltration according to the Hydrologic Evaluation of Landfill Performance (HELP) Model (U.S. Army Engineer Research and Development Center Waterways Experiment Station 1998). Precipitation at Site 14 is removed either by evaporation, evapotranspiration, surface runoff, or subsurface flow along the drainage layer to the detention basin and into the NBVCPH storm water ditch system.

5.2.3 Proposed Monitoring System

Number of Wells

There are 8 groundwater monitoring wells.

The proposed postclosure groundwater monitoring system for Site 14 consists of three upgradient monitoring wells to provide background data for groundwater that is not affected by the site and five downgradient detection wells to monitor groundwater as it exits the site. Figure 5-2 shows the proposed and existing positions of monitoring wells and depicts the mean groundwater gradient and flow direction at Site 14. Appendix D provides a detailed description of the groundwater monitoring system

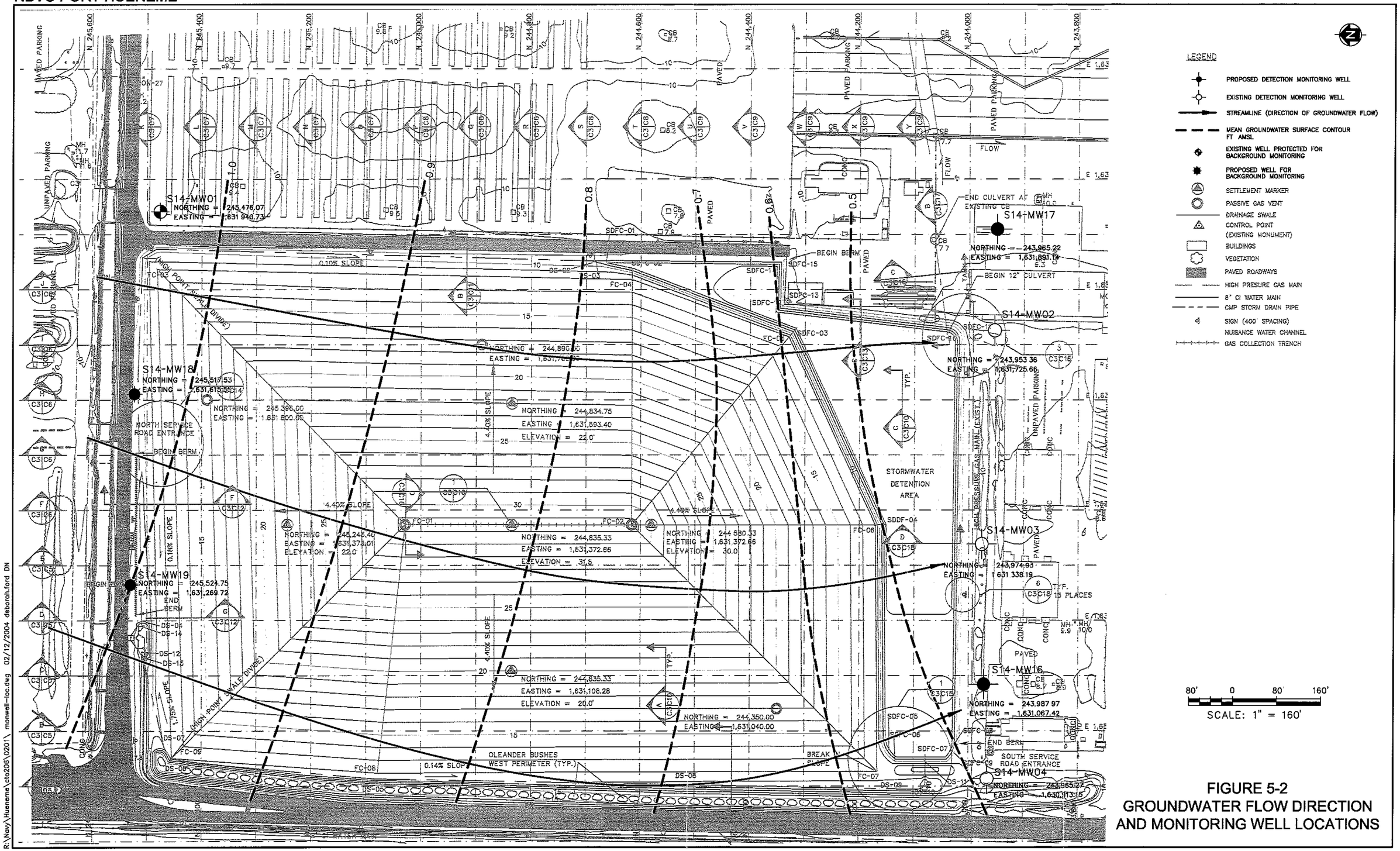

FIGURE 5-2
GROUNDWATER FLOW DIRECTION
AND MONITORING WELL LOCATIONS

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6.0 INSTITUTIONAL CONTROLS

Integration

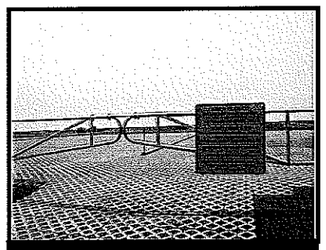
The PMP is put in the operating record through the RSIP

Institutional controls (IC) are mechanisms, particularly legal measures, designed to limit activities or access at a particular site. ICs for the Site 14 final cover are imposed under the Regional Shore Infrastructure Plan (RSIP) The RSIP describes procedures to fulfill the landfill owner's responsibilities, outside those of the maintenance contractor. These responsibilities include security, ensuring cover maintenance, ownership and rights issues, land use, and integration of the landfill site into surrounding land uses and planning The PMP must be entered in the operating record by reference in the RSIP.

6.1 INSTITUTIONAL CONTROL PROTOCOL

In January 1998, the California Military Environmental Coordination Committee (CMECC), composed of members of the United States military and California regulatory agencies, established the Institutional Control Protocol at Open Bases in the "Institutional Control Protocol at Open Bases" (CMECC Site Cleanup Performance Action Team 1999) The protocol is used as guidance to establish comprehensive institutional controls through the RSIP or through a Memorandum of Agreement (MOA) with DTSC An RSIP establishes land uses and similar "zoning-like" requirements. This PMP is to be used along with protocol guidance to establish ICs in the RSIP or MOA.

6.2 PASSIVE CONTROLS



A type of passive institutional control

Passive controls are set in place by design of the cover or exist through the Navy's control of the site and require no additional monies, labor, or equipment to operate

6.2.1 Site Security

The site is secured because it is entirely within the NBVCPH boundary Access to NBVCPH is controlled by five manned gates In all cases, identification must be provided for access to NBVCPH. Identification is provided through the security office for all visitors, residents, employees, contractors, or frequent commuters. However, once NBVCPH has been entered, there is no mechanism to restrict access to all areas within NBVCPH. However, entry to many areas is restricted through the use of signs, fences, controlled buildings, and gates

6.2.2 Signage

The site relies on signage as the primary access control (see Section 2.1) as originally designed but shall rely on chain-link fencing once installed. If signs are not preventing unauthorized access to the cover, the need for additional measures shall be noted in routine cover inspection reports. The Navy shall then work with the maintenance contractor to resolve deficiencies.

6.2.3 Site Access

As described in Section 2.2, control of access to the site relies on signs, gates, and swales. Fencing may be installed in the future. Although access to the site is possible by circumventing these controls, it is likely they will suffice. If unauthorized access becomes a problem, measures needed shall be noted in routine cover inspection reports. These measures may include placing telephone poles, rocks, fencing, or additional signage as a deterrence to site access.

The Navy shall work with the maintenance contractor to resolve any deficiency. Unauthorized access to the site may be the result of lack of communication among NBVCPH departments. The RSIP shall contain procedures to ensure that access and use restrictions for Site 14 are communicated to all pertinent NBVCPH departments and offices to prevent and monitor for unauthorized access.

Regional Shore Infrastructure Plan

Along with addressing and promulgating restrictions on site access, the RSIP shall also describe the procedures for land use changes; temporary uses; federal, state, and local permitting; and reporting.

6.2.4 Regional Shore Infrastructure Plan and Land Use

The RSIP is the primary mechanism for tracking and controlling land use at the site and shall comply with the provisions described in Section 7.0. Along with addressing and promulgating restrictions on site access, the RSIP shall also describe the procedures for land use changes; temporary uses; and federal, state, and local permitting.

Ownership

DTSC must be notified if the owner of the site changes.

Leasing

The RSIP shall ensure that leasing the site does not compromise the final cover.

6.2.5 NBVCPH Leasing, Closure, and Change of Ownership

Maintenance and preservation of the final cover may be compromised within the closure period if the owner or maintenance contractor is changed or discontinued, if a leasing agreement supersedes owner maintenance authority, or if NBVCPH is closed and ownership is transferred. DTSC must be notified if the owner of the site changes. Before title is transferred, the new owner shall be notified by the previous owner or its agent that these regulations and accompanying PMP exist. DTSC and IWMB shall be notified within 30 days of any title transfer (27 CCR 21630[a]; 21200[b]). The RSIP shall ensure that leasing the site does not compromise the final cover.

6.2.6 Financial Mechanisms

The RSIP shall address the availability of funds for uninterrupted cover maintenance and administrative costs within the owner's organization. The Navy's financial resources for postclosure maintenance is found in Appendix A, and any changes to the funding mechanism should be communicated to DTSC and IWMB. A new financial resources statement will be generated if the owner changes or if cover maintenance responsibility is transferred to a lessee.

6.3 ACTIVE CONTROLS

Active controls are not part of the design of the final cover and involve labor, equipment, or funds to perform, such as surveillance or guarding. These controls are not a part of maintenance contractor responsibilities and are not projected to be needed. If needed, however, the owner may choose to provide these additional controls to maintain the integrity of the cover.

Active Controls

The owner may choose to provide these additional controls to maintain the integrity of the cover, but they are not part of the cost opinion.

6.3.1 Surveillance

At no additional or at nominal cost, NBVCPH military police can include the final cover in their area of patrol and be apprised of the main security issues of the site using this PMP as guidance. Persistent security problems may require installation of video cameras or other active controls.

6.3.2 Additional Site Security

Deficiencies in signage and access restrictions may require installation of additional signs, bollards, barriers, fencing, or cables In addition, temporary or permanent posting of a guard on the site could be used to address chronic and persistent security issues.

7.0 POSTCLOSURE LAND USE

Change in Land Use

Any changes to site land use to other than nonirrigated open space shall be reported to DTSC, RWQCB, IWMB, and the County of Ventura.

This section provides guidance, recommendations, and prohibitions for the designer or developer of any future land use on or near the final cover. The current land use for Site 14 is nonirrigated open space. Any changes to site land use should be communicated to DTSC, RWQCB, IWMB, the County of Ventura Environmental Health Division, including the acting LEA. DTSC concurrence on proposed land use should be sought if it includes construction of structures within 1,000 feet of the final cover, structures on the final cover, irrigation on the final cover, or modification to the GCL, GDL or underground utilities. Construction on the site must not compromise the effectiveness of the final cover at any time. Land use that changes the cover components should be communicated to DTSC, RWQCB, IWMB, the County of Ventura Environmental Health Division, including the acting LEA. The Navy shall require that designs for any land use changes shall comply with the restrictions and requirements listed below.

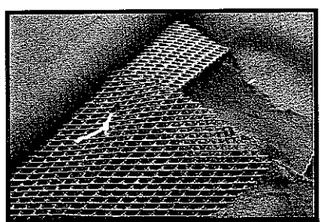
7.1 DESIGN BASIS FOR LAND USE

Land Use Design

The design basis for future land use shall include, at a minimum, the requirements of the Design Basis Report (TtEMI 1998b) and the substantive elements of 27 CCR 21190.

Postclosure land uses shall be designed and maintained to protect public health and safety, infrastructure, and the final cover. The design basis for future land use shall include, at a minimum, the requirements of the Design Basis Report (TtEMI 1998b) and the substantive elements of 27 CCR 21190. In summary, these requirements address structural improvements on the cover, additional protection for the cover system, construction within 1,000 feet of the final cover, storm drainage characteristics, and case-by-case exemptions to these requirements. For all land uses involving loads to the cover, an updated geotechnical evaluation is recommended that shall account for modified slopes and soil loadings.

7.2 LAND USE TYPES



A triplanar drainage layer increases land use options by improving slope stability

Three basic types of land use are suitable for the final cover. They are non-structures, structures, and shallow underground utilities. Any surface improvements must maintain cover integrity, especially with regard to surface drainage that may be concentrated and cause erosion. On-cover impoundments shall be lined. Resulting slopes on the cover must exceed 3 percent, unless an analysis shows adequate drainage (27 CCR 21090 [b][1][B]).

Affecting Infiltration

Any surface improvement that results in irrigation or increased water infiltration over the original design must be accompanied by an evaluation using the HELP model under the appropriate parameters found in the Design Basis Report.

Affecting Erosion

Any surface improvement must also be accompanied by a wind and water erosion analysis, in accordance with the procedure outlined in the Design Basis Report.

7.2.1 Non-Structures

A variety of land uses such as open space, parking lots, storage areas, staging areas, parks, and golf courses are included in the non-structures category. Cover surfaces other than nonirrigated vegetation are suitable as long as they protect and maintain the integrity of the GCL and GDL. Any surface improvement that results in irrigation or increased water infiltration over the original design must be accompanied by an evaluation using the HELP model under the appropriate parameters found in the Design Basis Report (ItEMI 1998b). The results must not predict GCL flow-through in excess of 2 inches per year. Any surface improvement must also be accompanied by a wind and water erosion analysis, in accordance with the procedure outlined in the Design Basis Report, that predicts less than 2 tons per acre per year soil loss

The use of durable pavement such as asphaltic concrete or concrete in future land use may allow for modification or removal, if necessary, of the GCL element under those areas, and allow an exemption from prohibitions pertaining to the low-hydraulic-conductivity layer only on concurrence from DTSC

7.2.2 Structures

On-cover structures and associated landscaping are subject to the same requirements and recommendations as for non-structures mentioned in Section 7.2.1, along with several additional requirements concerning gas, differential settlement, and cover integrity. Enclosed structures within 1,000 feet of the final cover are exempt from all these requirements except as they pertain to gas control measures.

Gas Control and Monitoring

The following requirements apply for on-cover enclosed structures

- Automatic methane gas alarms must be installed.
- Active or passive gas venting system must be installed
- Periodic methane gas monitoring shall be conducted inside buildings and underground utilities at least quarterly and according to a monitoring program that has the concurrence of the IWMB.

For enclosed structures within 1,000 feet of the final cover, the following requirements apply

- A low-gas-permeability membrane or system shall be installed at the subgrade level
- A permeable layer of clean aggregate, with geotextile filter fabric of appropriate apparent opening size and of 12 inches minimum thickness shall be installed below the low-permeability layer
- Perforated vents shall be installed in the permeable layer and be suitable for connection to an induced-draft exhaust system
- Automatic methane gas alarms shall be installed in the permeable layer and inside the structure
- Periodic methane gas monitoring shall be conducted inside buildings and underground utilities at least quarterly and according to a monitoring program that has the concurrence of the IWMB

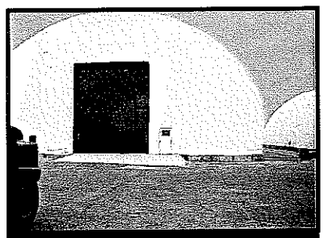
On concurrence by the IWMB, an exemption from or reduction of these requirements may be allowed based on 27 CCR 20921 and previous final cover design reviews

Geotech Analysis

Any future land use design must include a formal geotechnical analysis to ensure bearing capacity, slope stability, and acceptable settlement.

<u>Loading</u>

Any future land use design must include a formal geotechnical analysis to ensure bearing capacity, slope stability, and acceptable settlement In addition to the loading limitations pertaining to future land use, the final cover has a loading limitation determined by the long-term lateral drainage capacity (transmissivity) of the GDL Total long-term overburden above the GDL that exceeds 7,700 pounds per square foot (psf) may reduce drainage capacity and the factor of safety for slope stability as a result of increased pore pressure along the GCL interface This maximum 7,700 psf is the anticipated loading of the heaviest projected land use — covered storage for heavy equipment The geotechnical analysis made in the Geotechnical Investigation Report (Cyme 1998) was based on the unloaded final cover as designed



A type of high-load structure

<u>Differential Settlement</u>

Structures must accommodate differential settlement that may occur on the cover A geotechnical analysis must be performed using the same parameters as the Geotechnical Investigation Report (Cyme 1998), and be updated as necessary As mentioned above, Cyme's results were based on the final cover as designed

Sufficient Cover Soil

Cover soil is the primary means to protect the GCL and GDL DTSC may require additional cover soil to account for threats to cover integrity from structures or underground utilities

Additional Cover

The Navy may require additional cover soil to account for threats to cover integrity from structures or underground utilities.

7.2.3 Shallow Underground Utilities

Shallow underground utilities are permitted above the GDL Utilities must be limited to electricity, cable, telephone, gas, steam, water, or wastewater Other types of liquids are not recommended because of their potential to damage or impair surface vegetation, the GCL, or the GDL if leaking occurs Microtunneling and horizontal drilling are not recommended installation techniques because of the high risk of damaging the GDL or GCL Trenchless, continuous-coiled utility installation is preferred In the case where backhoe trenching is necessary, depth of cut must be carefully controlled

7.3 RESTRICTIONS ON FUTURE LAND USE

In order to protect the function of the final cover, certain restrictions apply to future land use

Land Use Restrictions

There are numerous types of land use that are prohibited.

Prohibitions

- Enclosed basement construction
- Utilities installed below the GCL
- Pilings or posts that penetrate the GCL, unless the GCL is repaired and sealed against the piling
- Static fixed loads in excess of 7,700 psf or bearing capacity calculated from geotechnical analysis, whichever is lesser, including all materials and constructions above the GDL
- Any construction on the final cover that exceed the capacities of underdrain, drainage control devices or structures; the detention area; or the surrounding storm drain network
- Ponding or unlined water impoundments
- Land use within 1,000 feet of the final cover that creates storm water runon
- Construction resulting in wind and water erosion that exceed 2 tons per acre per year combined

Geotechnical Considerations

The geotechnical properties of the site have significant impacts on potential future land use. These properties include earthquake behavior, liquefaction potential, settlement potential, and slope stability. A complete discussion of the parameters and findings for Site 14 is contained in the Geotechnical Investigation Report (Cyme 1998)

The project site is underlain by slightly compressible refuse and a moderately compressible layer of lower clay. The varying thickness of the earthfill portion of the existing landfill underlain by a varying thickness of the refuse and lower clay unit result in a varying magnitude of ultimate settlement. Since the existing landfill has been in place for decades, it is anticipated that most of the settlement has already occurred

Settlement

50 percent of the estimated ultimate settlement of 14 to 19 inches shall take place within 1 year after landfill closure. Another 40 percent shall take place within the next 1 to 2 years. Take into account date final overburden was placed on cover.

The controlling fault for the maximum probable earthquake (MPE) scenario is the Oakridge Fault, with an MPE moment-magnitude of 6.5 and horizontal peak ground acceleration of 0.38g at a distance of 10 kilometers. The lower 10-foot portion of the intermediate sand unit underlying the project site (at mean elevation between 10 and 15 feet below sea level) is likely to be subject to soil liquefaction during an MPE event

Drainage to GCL

Excessive differential settlement may damage the final cover system or any site improvements.

The settlement analysis indicated that approximately 50 percent of the estimated ultimate settlement of 14 to 19 inches will take place within 1 year after landfill closure, and that another 40 percent will take place within the next 1 to 2 years. Soil liquefaction during an MPE may cause the intermediate sand unit to settle about 3 inches during or within 1 week after the earthquake. The estimated ultimate settlement of the landfill final cover is expected to be relatively uniform across the site and is not likely to cause reverse slope gradient or any extensive water ponding on the exposed landfill surface. Should soil liquefaction occur in the intermediate sand unit, excessive differential settlement may result in localized areas where a significant quantity of refuse is present. Excessive differential settlement will damage the final cover system or any site improvements

8.0 EMERGENCY RESPONSE PLAN

Fast Access to PMP

The updated PMP and its emergency response plan shall be maintained at a location designated for Site 14 at all times.

This section describes the emergency response plan for Site 14 in the event of potential emergency situations and failure of the landfill cover. The updated PMP, including the emergency response plan, shall be maintained at a location designated for Site 14 at all times.

8.1 POTENTIAL EMERGENCY SITUATIONS

Although the Navy conducts operations to reduce the potential for emergencies, it is possible for events at the landfill to occur that cannot be prevented. This plan provides response procedures in Table 8-1 for the following situations or occurrences.

On-Hand Items

The maintenance contractor must ensure that these items are available on an immediate basis through prompt delivery or storage at NBVCPH and that appropriate equipment and materials are available.

- Vandalism
- Failure of dams, levies, and dikes
- Fires
- Explosions
- Earthquakes
- Tsunamis
- Floods
- Surface drainage problems
- Waste product releases
- Detected combustible gases

Assistance

In addition, the maintenance contractor will work with the Navy to ensure prompt and appropriate assistance from the fire, police, and public works departments.

Equipment and materials required to mitigate the emergencies include portable berm, absorbency media or blankets, loader/backhoe, clean fill soil, high-solids-pass explosion-proof portable pump, Baker tank or waste receptacles, cordon tape, sandbags, erosion control blankets or media, bulldozer, compactor, sand, chain-link fencing, bailing wire, silt fencing, and straw bales. These equipment and materials are commonly available commercial items. The maintenance contractor must ensure that these items are available on an immediate basis through prompt delivery or storage at NBVCPH. In addition, the maintenance contractor will work with the Navy to ensure prompt and appropriate assistance from the fire, police, and public works departments.

Changes

Certain changes on the cover cause emergency responses to be modified.

Emergency responses must be coordinated with NBVCPH Public Works and other departments.

8.2 EMERGENCY RESPONSE PROCEDURES

Table 8-1 provides recommended responses to the potential emergencies listed in Section 8 1. This plan is intended to address contingency situations that are reasonably foreseeable, but shall also be amended as follows:

- Whenever a failure or release occurs and the PMP did not provide an appropriate response
- When the postclosure use or structures on the site change in ways that are not addressed in the existing PMP
- When the Navy notifies the operator in writing that the current emergency response plan is inadequate
- Prior to entering an emergency area, an assessment should be made of the degree of risk to human health and safety for persons to be working in the vicinity of the emergency
- Prior to entering an emergency area, the immediate risk to the environment from the emergency should be determined. If the risk is imminent, it should be determined whether or not the emergency can be safely isolated to minimize damage to the environment
- After each emergency it should be determined whether or not the design of the facility met the design intent If failure of the cover occurs during a lesser or equal event, a design review and possible design change is called for

TABLE 8-1

EMERGENCY RESPONSES

Occurrence	Threat Posed	Response
VANDALISM	• Monitoring systems rendered inoperative • Site security compromised • Health or safety hazards, or both • Damage to cover or its components	**Initial Responder**: NBVCPH Public Works Department 1. Immediately inspect vandalism visually to assess damage and potential impacts. 2. In the event of a safety hazard, immediately cordon off the affected area. 3. Notify NBVCPH Police Department, Base Public Works, and Base Environmental Department 4. Notify NBVCPH Fire Department if conditions dictate. 5. For damage or potential damage to other components that affect site integrity, security, or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 6. Recommend preventative measures. 7. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, chain-link fencing, bailing wire, cordon tape.
FAILURE OF DAMS, LEVIES, AND DIKES	• No dams, levies, or dikes exist on or in the vicinity of Site 14	No response.
FIRE	• Health and safety hazards • Damage to monitoring systems • Damage to cover or its components	**Initial Responder**: NBVCPH Fire Department 1. Notify NBVCPH Fire Department. 2. Immediately inspect area visually to assess damage and potential impact. 3. Immediately cordon off affected area. 4. For subsurface refuse fires: a. Excavate and separate burning refuse. b. If necessary, apply water to excavation area and excavated refuse. 5. For damage or potential damage to other components that affect site integrity, security, or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 6. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: fire pumper, erosion control blankets or media, silt fencing, straw bales, sandbags, bulldozer, loader, compactor, sand, clean fill, cordon tape.

TABLE 8-1 (Continued)

EMERGENCY RESPONSES

Occurrence	Threat Posed	Response
EXPLOSION	• Health and safety hazard • Site security • Damage to cover or its components	**Initial Responder**: NBVCPH Fire Department 1. Immediately inspect area visually to assess damage and potential impact. 2. In the event of safety hazard, immediately cordon off the affected area. 3. Area to be closed off within 500 feet. 4. For damage or potential damage to components that affect site integrity, security, or safety, arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions in accordance with construction specifications. 5. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, silt fencing, straw bales, sandbags, cordon tape.
EARTHQUAKE (Richter Magnitude 6.0 or greater within 40-mile radius)	• Health and safety hazards • Damage to monitoring systems • Slope failure • Damage to cover or its components	**Initial Responder**: NBVCPH Public Works Department 1. Immediately inspect area visually to assess damage and potential impact. 2. In the event of safety hazards, immediately cordon off area. 3. In the event of damage to monitoring systems, contact maintenance contractor to facilitate repairs. 4. Resurvey the landfill and increase the frequency of inspection and maintenance of final cover, drainage system, vegetative cover, and final grading to quarterly for 1 year. 5. In the event of apparent slope failure or surface cracking, contact the contracted geotechnical consultant, as appropriate, to participate in an evaluation of problem area within 48 hours notice. If necessary, perform a geotechnical investigation of failure to develop corrective action plan. 6. For damage or potential damage to other components that affect site integrity, security or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions in accordance with construction specifications. 7. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, cordon tape.

TABLE 8-1 (Continued)

EMERGENCY RESPONSES

Occurrence	Threat Posed	Response
TSUNAMI	• Health and safety hazards • Damage to monitoring systems • Slope failure • Damage to cover or its components	**Initial Responder**: NBVCPH Public Works Department 1. Immediately inspect area visually to assess damage and potential impact. 2. In the event of safety hazards, immediately cordon off area. 3. In the event of damage to monitoring systems, contact maintenance contractor to facilitate repairs. 4. Resurvey the landfill and increase the frequency of inspection and maintenance of final cover, drainage system, vegetative cover, and final grading to quarterly for 1 year. 5. In the event of apparent slope failure, surface cracking, etc., contact the contracted geotechnical consultant, as appropriate, to participate in an evaluation of problem area within 48 hours. If necessary, perform a geotechnical investigation of failure to develop corrective action plan. 6. For damage or potential damage to other components that affect site integrity, security or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions in accordance with construction specifications. 7. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, cordon tape.
FLOODING	• Excessive erosion of surface or levees • Slope failure • Health and safety hazards • Damage to cover or its components	**Initial Responder**: NBVCPH Public Works Department 1. Immediately inspect area visually to assess damage and potential impact. 2. In the event of safety hazard, immediately cordon off the affected area. 3. In the event of slope failure, contact contract geotechnical consultant, as appropriate, to participate in an evaluation of problem area with 48 hours. If necessary, conduct a geotechnical investigation of the failure in order to develop a corrective action plan. 4. For damage or potential damage to components that affect site integrity, security, or safety, arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 5. Investigate preventative measures. 6. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, cordon tape.

TABLE 8-1 (Continued)

EMERGENCY RESPONSES

Occurrence	Threat Posed	Response
SURFACE DRAINAGE PROBLEMS	• Excessive erosion of surfaces • Slope failure • Flooding • Damage to cover or its components	**Initial Responder**: NBVCPH Public Works Department 1. Immediately inspect area visually to assess damage and potential impact. 2. In the event of slope failure, contact contract geotechnical consultant, as appropriate, to participate in an evaluation of problem area with 48 hours. If necessary, conduct a geotechnical investigation of the failure in order to develop a corrective action plan. 3. If possible, immediately remove the cause of drainage problems or clogging. Otherwise, immediately employ measures to minimize erosion and prevent runoff leaving the site. 4. For damage or potential damage to components that affect site integrity, security, or safety, arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 5. Investigate preventative measures. 6. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, cordon tape.
WASTE PRODUCT RELEASE	• Health and safety hazards	**Initial Responder**: NBVCPH Public Works Department 1. Immediately inspect area visually to assess damage and potential impact. 2. In the event of safety hazards, immediately cordon off area. 3. Notify discharger, if discharger can be identified, to remove the waste. 4. Identify the discharged material, if possible. If hazardous or toxic, contact a licensed company that handles hazardous or toxic waste disposal to remove the waste. 5. Use necessary heavy equipment to rectify matters. 6. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: portable berm, absorbency media or blankets, loader/backhoe, clean fill soil, high-solids-pass explosion-proof portable pump, Baker tank or waste receptacles, cordon tape, sandbags.
DETECTED COMBUSTIBLE GAS	• Health and safety hazards	**Initial Responder**: NBVCPH Fire Department 1. In the event of safety hazard, immediately cordon off the affected area. 2. Use contract maintenance personnel to take corrective action. 3. Notify DTSC, IWMB, and RWQCB. **Required Equipment**: cordon tape

Notes:

NBVCPH Construction Battalion Center
DTSC Department of Toxic Substances Control
IWMB Integrated Waste Management Board
RWQCB Regional Water Quality Control Board

9.0 POSTCLOSURE MAINTENANCE COST OPINION

Cost Assumptions

The cost opinion contains important assumptions

The architect and engineer opinion of probable cost to inspect and maintain the landfill cover is provided in Appendix E The present value of 30 years of landfill maintenance is $790,122 or an average of $26,337 per year, using an inflation rate of 3 percent, a discount rate of 6 percent, and including a 20 percent contingency factor. Any changes to maintenance tasks, costs or anticipated year of closure shall be reflected in an updated cost opinion

REFERENCES

California Military Environmental Coordination Committee (CMECC) Site Cleanup Performance Action Team. 1999 "Institutional Control Protocol at Open Bases" Online address: www.cedar.ca.gov/military/icprotoc.html

Cyme Inc. 1998. Geotechnical Investigation Report - Proposed Final Cover Design for Site 14, Naval Construction Battalion Center, Port Hueneme, California

PRC Environmental Management, Inc. (PRC) 1997. Final Remedial Investigation Report, Sites 9, 14, 17, and 21, NBVCPH Port Hueneme, Port Hueneme, California. May 23

Tetra Tech EM Inc. (TtEMI) 1998a. Design Basis Report (Revised) for the Site 14 Landfill Final Cover at NBVCPH Port Hueneme, Port Hueneme, California. December 18

TtEMI. 1998b. Construction Specifications for the Site 14 Landfill Final Cover at NBVCPH Port Hueneme, Port Hueneme, California. June 26.

U.S. Army Engineer Research and Development Center Waterways Experiment Station (Army Corps of Engineers). 1998. Hydrologic Evaluation of Landfill Performance (HELP) Model Version 3.04 Latest version available at http://www.wes.army.mil/el/elmodels/index.html#landfill.

U.S. Environmental Protection Agency (EPA) 2001. Comprehensive Five-Year Review Guidance, OSWER No. 9355.07-03B-P. June.

U.S. Geological Survey. 1967. Specific Yield - Compilation of Specific Yields for Various Materials Geological Survey Water Supply Paper 1662-D

U.S. Department of the Navy (Navy). 1998. Letter Regarding Soil Gas Sampling at NBVCPH Port Hueneme Site 14, Former Earth Moving Training Area. To Mr. Scott Humpert, Associate Waste Management Engineer, Permitting and Enforcement Division, Remediation, Closure, and Technical Services, Integrated Waste Management Board. June 17

APPENDIX A

FINANCIAL RESOURCES FOR POSTCLOSURE MAINTENANCE

APPENDIX A

STATEMENT OF FINANCIAL RESPONSIBILITY

Naval Base Ventura County resides under the Naval Region Southwest Command which resides within the Commander In Charge Pacific Fleet (CINCPACFLT). All operating funds to NBVC originate from CINCPACFLT and is budgeted and provided to NBVC on an annual basis. Landfill operating funds are requested as priority funds since the California Code of Regulations requires that specific maintenance needs be performed for satisfactory operation of the landfill cover. As long as this landfill cover is operated by NBVC, financial responsibility can be assured. Should the Navy decide to close NBVC from service, then the existence of the landfill and its operational requirements will be included in an Environmental Baseline document that is conducted for all closing bases. In the event of the base closing, Naval Facilities Engineering Command will operate the base in a caretaker status until the landfill is transferred to another government or private agency. Responsibilities for operating and maintaining the landfill will be detailed in the Environmental Baseline document and the new owner will assume responsibility when the deed is transferred

APPENDIX B

FULL-SIZE MAINTENANCE ELEMENTS MAP

APPENDIX C

REPAIR SPECIFICATIONS

APPENDIX C

REPAIR SPECIFICATIONS SUMMARY

C-01450	Quality Control
C-02141	Passive Gas Vent
C-02243	Drainage Layer
C-02302	Excavation, Backfilling, and Earthmoving
C-02442	Geosynthetic Clay Liner
C-02535	Underdrain
C-02821	Signs and Gates
C-02822	Chain Link Fences and Gates
C-02922	Landscaping
C-03300	Cast-In-Place Concrete

C - 01450
QUALITY CONTROL

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1077	(1996) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3740	(1995) Agency Engaged in the Testing and Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1995) (Rev C) Agencies Engaged in the Testing and Inspection of Materials Used on Construction
ASTM E 543	(1995 Rev. A) Evaluating Agencies that Perform Nondestructive Testing

CALIFORNIA CODE OF REGULATIONS

Title 27 §20324	Construction Quality Assurance Requirements

1 2 SUBMITTALS

Submit a Quality Control Plan for Maintenance and Repair to the Contracting Officer or authorized Navy representative within 30 calendar days before the beginning of the period of performance.

1 3 INFORMATION FOR THE CONTRACTING OFFICER OR AUTHORIZED NAVY REPRESENTATIVE

Deliver the following to the Contracting Officer or authorized Navy representative:

a Combined Contractor Maintenance and Repair Report/Contractor Quality Control Report (1 sheet): Original and 1 copy, by 10:00 a.m. the next working day after each day that work is performed;

b Quality Control (QC) Certifications: As required by Paragraph 1 9 QC Certifications

1 4 QC ORGANIZATION

1 4 1 QC Manager

j. Documentation procedures, including proposed report formats.

k A list of the definable features of work. A definable feature of work is a task that is separate and distinct from other tasks and requires separate control requirements. At a minimum, if approved by the Contracting Officer, consider each section of the specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each section of the specifications.

1 5 2 Approval

Approval of the QC plan is required before maintenance or repair begins. The Contracting Officer or authorized Navy representative reserves the right to require changes in the QC plan and operations as necessary to ensure the specified quality of work is achieved. The Contracting Officer or authorized Navy representative reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel shall be subject to acceptance by the Contracting Officer or authorized Navy representative.

1 5 3 Notification of Changes

Notify the Contracting Officer or authorized Navy representative, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of 7 calendar days before a proposed change is implemented. Proposed changes must be approved by the Contracting Officer or authorized Navy representative.

1 6 QC PLAN MEETING

Meet with the Contracting Officer or authorized Navy Representative to discuss the requirements of the QC plan of this contract before the QC plan is submitted. The purpose of this meeting is to develop a mutual understanding of the requirements of the QC plan before the plan is developed and submitted.

1 7 QC MEETINGS

After the start of the maintenance period of performance, the QC Manager shall conduct QC meetings with the project superintendent within 2 days after work is performed or quarterly, whichever is less. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer or authorized Navy representative within 2 working days after the meeting. The Contracting Officer or authorized Navy representative may attend these meetings. The QC Manager shall notify the Contracting Officer or authorized Navy representative at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

a Review the minutes of the previous meeting

b. Review the schedule and the status of work:

Work or testing accomplished since last meeting

American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer or authorized Navy representative a copy of the Certificate of Accreditation, Scope of Accreditation, and latest directory of the accrediting organization for accredited laboratories The scope of the laboratory's accreditation shall include the test methods required by the Contract

1.8.3 Inspection of Testing Laboratories

Before nonaccredited laboratories will be approved, the proposed testing laboratory facilities and records may be subject to inspection by the Contracting Officer or authorized Navy representative. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and internal QC procedures

1.8.4 Capability Check

The Contracting Officer or authorized Navy representative retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.8.5 Test Results

Cite applicable contract requirements, tests, or analytical procedures used Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements If the item fails to conform, notify the Contracting Officer or authorized Navy representative immediately. Conspicuously stamp the cover sheet for each report in large red letters **CONFORMS** or **DOES NOT CONFORM** to the specification requirements, whichever is applicable. Test results shall be signed by a representative of the testing laboratory authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer or authorized Navy representative via the QC Manager Furnish a summary report of field tests at the end of each month Attach a copy of the summary report to the last Contractor Quality Control Report of each month

1.9 QC CERTIFICATIONS

1.9.1 Contractor Quality Control Report Certification

Each Contractor Quality Control Report shall contain the following statement: *On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the Contract drawings and specifications to the best of my knowledge, except as noted in this report.*

1.9.2 Invoice Certification

Furnish a certificate to the Contracting Officer or authorized Navy representative with each payment request, signed by the QC Manager, attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements

g. Include a remarks section in this report that will contain pertinent information including directions received, problems encountered, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, and a record of visitors to the work site.

1 10 2 Contractor Quality Control Report

Reports are required for each day that work was performed Account for each calendar day throughout the life of the contract The reporting of work shall be identified by terminology consistent with the maintenance schedule. Contractor Quality Control Reports are to be prepared, signed, and dated by the QC Manager, and shall contain the following information:

a. Include a *remarks* section in this report which will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, deficiencies encountered, QC meetings held, corrective direction given by the QC Organization, and corrective action taken by the Contractor

b List the rework items identified but not corrected by close of business.

c List the rework items corrected from the rework items list along with the corrective action taken

d. Contractor Quality Control Report Certification

1 10 3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks and acknowledgment that an accredited or Contracting Officer-approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

1 10 4 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Contracting Officer

1 10 5 Report Forms

The following forms, which are attached at the end of this section, are acceptable for providing the information required by Paragraph 1 10 Documentation While use of these specific formats is not required, any other format used shall contain the same information:

a Combined Contractor Production Report/Contractor Quality Control Report (1 sheet), with separate continuation sheet

C - 02141
PASSIVE GAS VENT

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1785 (1994) Standard Specification for Polyvinyl Chloride (PVC), Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2467 (1994) Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2564 (1993) Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2855 (1993) Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

PART 2 PRODUCTS (all products shall match those found on As-Built Construction Drawings, As-Built Materials List, or alternatively, as described in this Part)

2.1 POLYVINYL CHLORIDE (PVC) PIPE

2.1.1 Pipe

ASTM D 1785, PVC 1120, Schedule 80, Type I, Grade 2.

2.1.2 Fittings

Fittings, same size and type as pipe, ASTM D 2467.

2.1.3 Solvent Cement

ASTM D 2564

2 2 CEMENT GROUT

According to C-03300, Cast-in-Place Concrete.

2.3 COARSE AGGREGATE

According to C-02535, Underdrain

C - 02243
DRAINAGE LAYER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1238	(1989) Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1505	(1985) Test Method for Density of Plastic by the Density Gradient Technique
ASTM D 3776	(1996) Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D 4218	(1986) Test Method for Carbon Black Content in Polyethylene Compounds
ASTM D 4355	(1992) Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water
ASTM D 4491	(1989) Test Methods for Water Permeability of Geotextiles by Permissivity
ASTM D 4533	(1991) Test Method for Trapeziod Tearing Strength of Geotextiles
ASTM D 4595	(1986) Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4716	(1987) Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products
ASTM D 4751	(1995) Test Method for Determining the Apparent Opening Size of a Geotextile
ASTM D 4833	(1988) Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 5321	(1992) Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
ASTM F 904	(1991) Comparison of Bond Strength or Ply Adhesion of Similar Laminated Made from Flexible Materials

PROPERTY	TEST METHOD	TEST VALUE
Interface Frictional Shear Strength, min (defined as: [cohesion, psf]+[confining pressure, psf]TAN[friction angle], where cohesion and friction angle are determined per ASTM D 5321) Modified Proctor curve must be generated per soil sample tested. Test must be performed at a minimum of 90% maximum dry density Parameters: Hydration: Saturate GCL and GDL 48 hours; Soil 2% above optimum moisture content Soil Compaction: 95% Modified Proctor at 2% above optimum moisture content Consolidation: seat 8 hours at given stress Shear Rate: 0.04 inches per minute Stress 1st Load: 125 psf Stress 2nd Load: 200 psf Stress 3rd Load: 250 psf		
GCL-Foundation Layer (1 test per 200,000 sqft)	ASTM D 5321	44 psf @ 250 psf confining pressure 22 psf @ 125 psf confining pressure
GCL-Drainage Layer (1 test per 200,000 sqft)	ASTM D 5321	22 psf @ 125 psf confining pressure 22 psf @ 125 psf confining pressure

Note 1 ASTM D 4716 shall be followed but with transmissivity values recorded at 0, 1, 2, 5, 10, 100, 1,000, and 10,000 hours. The results shall be plotted transmissivity versus time. Extrapolations of the data to 30 years or 263,000 hours must conclude that minimum transmissivity is met. Loading conditions greater than 7,700 psf and gradients less than 0.04 are acceptable

2.3 SAMPLING AND TESTING

2.3.1 General Requirements

Certified test results on all samples shall be submitted to the Engineer and approved 14 days prior to delivery to the site.

maximum of 2 feet across the side slope roll overlaps. Fasteners shall be of contrasting color from the geocomposite to facilitate visual inspection. Geocomposites shall not be bonded to geomembranes

In the corners of side slopes, where overlaps between rolls of geocomposite are staggered, an extra layer of geocomposite shall be installed from the top to the bottom of the slope

3 2 SMALL REPAIRS

Holes or tears in the geocomposite shall be repaired by placing a patch of geocomposite extending a minimum of 2 feet beyond the edges of the hole or tear. Approved fasteners, spaced every 6 inches around the patch, shall be used to fasten the patch to the original roll.

3 3 PENETRATIONS

Geocomposite penetration details shall be recommended by the geocomposite manufacturer and as approved by the Contracting Officer or authorized Navy representative

3 4 FINAL COVER

3 4 1 Vegetative Soil Layer

On side slopes, soil backfill shall be placed from the bottom of the slope upward. The overlying material shall not be deployed such that excessive tensile stress is developed in drainage layer or underlying GCL. Cover soil shall be free of angular stones or sharp objects that could damage the drainage layer. Cover soils with high concentrations of calcium or chloride as indicated by the manufacturer are not acceptable.

3 4 2 Damage Avoidance

Soil cover shall be placed over the drainage layer using construction equipment that minimizes stresses on the drainage layer and underlying GCL. Although direct vehicular contact with the drainage layer should be avoided, lightweight, low ground pressure vehicles (such as 4-wheel, all-terrain vehicles) may be used to facilitate installation. The drainage layer supplier shall provide specific recommendations on the appropriate procedures in this situation. A minimum thickness of 1 foot of cover should be achieved before heavy equipment traffic. This thickness recommendation does not apply to frequently trafficked areas or roadways, for which a minimum thickness of 18 inches is required

Potential damage to the drainage layer and underlying GCL shall be avoided by allowing generous turning radii for heavy equipment. Locked tracks or wheels should be avoided.

END OF SECTION

C - 02302
EXCAVATION, BACKFILLING, AND EARTHMOVING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	Specification for Concrete Aggregates
ASTM C 140	Sampling and Testing Concrete Masonry Units
ASTM D 422	(1990) Test Method for Particle Size Analysis for Soils
ASTM D 1140	(1992) Amount of Material in Soils Finer than the No. 200 (75-Micrometer) Sieve
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft)
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1992) Classification of Soils for Engineering Purposes
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2974	(1995) Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D 3017	(1988) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995) Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

SS-1	(July 1992) Standard Specifications

1 2 10 Coarse Aggregate

Coarse aggregate is used for gas vent pockets, underdrain piping (C-02535), and as a capillary break for overlying root zones as shown on the As-Built Drawings

1 3 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

PART 2 PRODUCTS (all products shall match those found on As-Built Construction Drawings, As-Built Materials List, or alternatively, as described in this Part)

2 1 BURIED WARNING AND IDENTIFICATION TAPE

Metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, in green to signify sewer systems with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, **CAUTION BURIED STORM DRAIN LINE BELOW** or similar wording. Color and printing shall be permanent, unaffected by moisture or soil

2 1 1 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1,500 psi lengthwise and 1,250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection

2 2 FOUNDATION LAYER MATERIAL

Material shall be reused to the extent possible as foundation layer material. If more material is required, it shall be imported from off-site after approval from the Contracting Officer or authorized Navy representative. The maximum particle dimension shall be 6 inches, except for the top 6 inches of the foundation layer that shall not have any particles larger than 2 inches to prevent damage to the overlying geosynthetic clay liner (GCL)

2 2 1 Soil Classification

Imported foundation layer material shall be less than or equal to 2 percent organic content per ASTM D 2974, with a plasticity index between 4 and 12 percent per ASTM D 4318, with a dry density between 115 and 130 pounds per cubic foot, and with less than 50 percent passing a 200 US standard sieve.

2 6 BEDDING SAND

Bedding sand shall be clean, nonplastic, and free from deleterious or foreign matter The sand shall be natural or manufactured from crushed rock Limestone screenings or stone dust shall not be used Bedding sand shall conform to the grading requirements of ASTM C 33 as shown below:

Sieve Size	Percent Passing
$^3/_8$"	100
No 4	95 - 100
No 8	85 - 100
No 16	50 - 85
No 30	25 - 60
No 50	10 - 30
No 100	2 - 10

2 7 PAVING STONE

Paving stone shall be prefabricated interlocking concrete paving units with a maximum thickness of 4 inches Paving stone shall meet the following requirements in accordance with ASTM C 140:

1 Average compressive strength of 4,000 psi with no individual unit under 3,000 psi.
2 Average absorption of 7 percent with no unit greater than 10 percent.

All units shall be sound and free of defects that would interfere with proper placing of unit or impair the strength or permanence of the construction. Minor cracks incidental to the usual methods of manufacture, or chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection

2 8 TOPSOIL

Natural, friable soil representative of productive, well-drained soils, free of sub-soil, stumps, rock larger than 1 inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth Topsoil may be vegetative soil layer material if such material meets the topsoil requirements in this section Topsoil shall not contain metals above basewide metals background levels as provided in Table 1 using EPA SW 846

PART 3 EXECUTION

3.1 GENERAL COMPACTION REQUIREMENTS

Unless specified otherwise below, the following compaction requirements shall be met:

Any areas of the foundation layer that require unreasonable compaction effort are eligible for the relaxation of the 95 percent compaction requirement. The minimum compaction allowable in any location is 90 percent for normal soil conditions However, soils in the detention area are influenced by surfacing groundwater influenced by the tides. Compaction of these soils and

Soils shall be tested for the following constituents:

Nitrate-Nitrogen	Calcium	Sodium Adsorption Ratio
Phosphorus	Magnesium	Boron
Potassium	Sodium	Chloride
Sulfate	Zinc	Manganese
Iron	Copper	Cation Exchange Capacity
Percent Base Saturation	Limestone	Lime Requirement
pH	Soil Salinity	Organic Matter
Gypsum Requirement		

The soil test laboratory shall recommend soil amendment type and application rate.

3 5 3 Hydroseed

Provide as specified in C-02922, Landscaping

3 5 4 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlement that may occur Repair or re-establish damaged grades, elevations, or slopes as indicated in this specification.

3 6 DISPOSAL OF SURPLUS MATERIAL

Dispose of all surplus materials or other non-suitable material, including brush, refuse, stumps, roots, and timber into an appropriate off-site disposal facility.

3 7 FIELD QUALITY CONTROL

3 7 1 Sampling

Collect the number and size of samples required to perform the specified tests of source materials

3 7 2 Source Testing

Determine laboratory compaction characteristics and soil classification for each material used Provide additional tests for every source change. Foundation layer source materials shall be in accordance with ASTM D 422 for conformance to ASTM D 2487 gradation limits; test source materials in accordance with ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 1557 for moisture density relationship, and ASTM D 4318 for Atterburg limits.

Sample all imported Foundation Layer, Vegetative Soil Layer, and Topsoil Layer materials once per source. Collect samples according to laboratory instruction. Laboratory shall analyze samples according to EPA SW 846 Sources that do not meet the requirements of Table 1 shall be rejected

TABLE 1

Metals Limits for
Imported Foundation, Vegetative Soil, and Topsoil Layers

Metal	Limit (mg/kg)
Aluminum	7.7×10^4
Antimony	3.1×10^1
Arsenic	2.2×10^1
Barium	5.4×10^3
Beryllium	1.5×10^{-2}
Cadmium	3.8×10^1
Chromium	2.1×10^2
Cobalt	4.7×10^3
Copper	2.9×10^3
Lead	4.0×10^2
Manganese	3.2×10^3
Molybdenum	3.9×10^2
Nickel	1.6×10^3
Selenium	3.9×10^2
Silver	3.9×10^2
Sodium	1.2×10^3
Vanadium	5.5×10^2
Zinc	2.3×10^4

Note: Limit constitutes the greater of a) 95 Percent Upper Confidence Limit (PRC) or b) Preliminary Remedial Goals for Residential Soil (Smucker)

Sources:

PRC Environmental Management, Inc 1997 Final Remedial Investigation Report, Sites 9, 14, 17, and 21, NCBC Port Hueneme, Port Hueneme, California May 23

Smucker, Stanford J., Ph D 2000 Preliminary Remedial Goals Version 4 U.S. Environmental Protection Agency Region IX, Technical Support Section (H-9-3), 75 Hawthorne Street, San Francisco, California 94105-3901

C - 02442
GEOSYNTHETIC CLAY LINER (GCL)

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2216	(1998)	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4595	(1994)	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632	(1991)	Grab Breaking Load and Elongation of Geotextiles
ASTM D 4643	(2000)	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D 5084	(1990)	Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5321	(1992)	Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
ASTM D 5887	(1997)	Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Using Flexible Wall Permeameter
ASTM D 5889	(1997)	Standard Practice for Quality Control of Geosynthetic Clay Liners
ASTM D 5890	(1997)	Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
ASTM D 5891	(1997)	Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liner
ASTM D 5993	(1996)	Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners
ASTM D 6072	(1996)	Standard Guide for Obtaining Samples of Geosynthetic Clay Liners

PART 2 PRODUCTS (all products shall match those found on As-Built Construction Drawings, As-Built Materials List, or alternatively, as described in this Part)

2 1 GCL

GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two geotextiles GCL shall conform to the property requirements listed in Table 1 and shall be free of tears, holes, or other defects that may affect its serviceability Encapsulating geotextiles shall be woven and mechanically bonded using a needle punch process The GCL shall be continuously inspected for broken needles using an in-line metal detector, and broken needles shall be removed. The minimum manufactured GCL sheet width shall be 13 5 feet and the minimum manufactured GCL sheet length shall be 100 feet

2 2 TESTS, INSPECTIONS, AND VERIFICATIONS

2 2 1 Manufacturing Sampling and Testing

GCL, its components, and bentonite used for repairs shall be sampled and tested in accordance with the manufacturer's approved quality control manual and in conformance with ASTM D 5889 Test results not meeting the requirements specified in Table 1 shall result in the rejection of applicable rolls The manufacturer's quality control manual shall describe procedures used to determine rejection of applicable rolls. As a minimum, rolls produced immediately prior to and immediately after the failed roll shall be tested for the same failed parameter Testing shall continue until a minimum of two successive rolls on both sides of the original failing roll pass the failed parameter

PART 3 EXECUTION

3 1 SITE VERIFICATION SAMPLING AND TESTING

Samples for testing shall be collected by the Contractor upon delivery of the GCL to the site Samples will be collected and packaged using ASTM D 6072 at a frequence of one sample per every 100,000 square feet collected by cutting the full-width of the GCL sheet, 3 feet long Samples shall be identified by manufacturer's name, product identification, lot and roll number The machine direction shall also be noted on the sample with a waterproof marker The independent laboratory shall determine swell index, fluid loss, and bentonite mass per unit area at a frequency of once per 100,000 square feet

Permeability and tensile strength shall be at a frequency of once per 200,000 square feet

One direct shear friction test will be performed per ASTM D 5321 for every 200,000 ft^2 of material to determine cohesion and friction angle between the GCL-foundation layer interface and between the GCL-drainage layer interface

Tests not meeting the requirements specified in Table 1 shall result in the rejection of applicable rolls Determination of applicable rolls shall be as described in Paragraph 2.2 Tests, Inspections and Verifications

TABLE 1 - GCL PROPERTIES (Continued)

	TEST METHOD	TEST VALUE
GCL-Drainage Layer	ASTM D 5321	44 psf @ 250 psf confining pressure
(1 test per 200,000 sqft)		22 psf @ 125 psf confining pressure
GCL-Vegetative Soil Layer	ASTM D 5321	122 psf @ 250 psf confining pressure
(detention pond slopes only; 1 test per 500 LF)		86 psf @ 125 psf confining pressure

Note 1: Bentonite mass/unit area is based on a GCL moisture content of 0 percent as determined by ASTM D 5993. Bentonite mass/unit area is exclusive of glues added to the bentonite. MARV = Minimum average roll value

Note 2: Represents yield strength for geomembrane backed materials

Note 3: Minimum internal shear strength measured at 200 psf normal loading.

3.5 PROTECTION

Adequate ballast (for example sand bags) shall be placed on GCL to prevent uplift by wind. Only GCL panels that can be anchored and covered in the same day shall be unpackaged and installed. If exposed GCL cannot be covered before the end of a working day, it shall be temporarily covered with plastic or other waterproof material and ballasted until construction can resume. GCL shall be trimmed and granular bentonite shall be placed to avoid contamination of drainage materials by bentonite particles

3.6 SMALL REPAIRS

Holes, tears, or rips in GCL shall be repaired by placing a patch of GCL extending a minimum of 12 inches beyond the edges of the hole or tear Patches shall be secured with a construction adhesive or other approved methods as recommended by the manufacturer.

3.7 PENETRATIONS

Penetration details shall be as recommended by the GCL manufacturer and as instructed in these specifications. As a minimum, penetrations shall incorporate hydrated sodium bentonite applied at least 3 inches above and below.

3.8 COVERING

Coverings over the GCL shall be placed using construction equipment that minimizes stresses on the drainage layer and underlying GCL Although direct vehicular contact with the GCL should be avoided, lightweight, low ground pressure vehicles (such as 4-wheel, all-terrain vehicles) may be used to facilitate t installation of any geosynthetic material placed over the GCL The GCL supplier shall provide specific recommendations on the appropriate procedures in this situation GCL shall not be covered until it has been inspected and approved by the Contracting Officer or authorized Navy representative

END OF SECTION

C - 02535
UNDERDRAIN

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M252 (1994) Corrugated Polyethylene Drainage Tubing, 3" to 10" Diameter

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3776 (1996) Mass Per Unit Area (Weight) of Fabric

ASTM D 4355 (1992) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)

ASTM D 4491 (1992) Test Methods for Water Permeability of Geotextiles by Permissivity

ASTM D 4632 (1991) Test Method for Elongation of Geotextiles

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans)

SS-1 July 1992 Standard Specifications

1 2 DEFINITIONS

1 2 1 Underdrain System

All subsurface drainage trenches and associated appurtenances below the Vegetative Soil Layer composed of the following items: 6- or 8-inch corrugated, perforated high-density polyethylene (HDPE) pipe, coarse aggregate, and filter fabric. Items that are included in construction but are not defined as the Underdrain System include a geocomposite drainage layer and GCL layer.

Property	Specification	Requirement
Weight, ounces per square yard, min.	ASTM D 3776	6.0
Grab Tensile strength (1-inch grip), pounds, min. in each direction	ASTM D 4632	90
Elongation at break, percent, min.	ASTM D 4632	30
Toughness, pounds, min	---	6,000
Permissivity, 1/sec., min	ASTM D 4491	0.5

If filter fabric is to be exposed for more than 72 hours, all fabric shall be treated with ultraviolet ray (UV) protection. The treated fabric shall provide a minimum of 70 percent breaking strength retention after 500 hours exposure when tested in accordance with ASTM Designation: D 4355.

2.3 COARSE AGGREGATE

According to C-02302 Excavation, Backfilling, and Earthmoving

2.4 CONCRETE

According to C-03300, Cast-In-Place Concrete

PART 3 EXECUTION

3.1 REPAIR OF UNDERDRAINS AND APPURTENANT CONSTRUCTION

3.1.1 Earthwork

Perform earthwork operations in accordance with C-02302, Excavation, Backfilling, and Earthmoving. Overexcavate as necessary to expose damaged section

3.1.2 Underdrain System

3.1.2.1 Filter Fabric Repair

Where fabric is damaged, place a new piece of filter fabric over damaged area and overlap at least 12 inches in every direction. Surfaces to receive filter fabric, immediately before placing, shall be free of loose or extraneous material and sharp objects that may damage the filter fabric during installation. Should the fabric be damaged during placing, the torn or punctured section shall be either completely replaced or shall be repaired by placing a piece of fabric that is large enough to cover the damaged area and to meet the overlap requirement

C - 02821
SIGNS AND GATES

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referenced in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 145	Accident prevention Signs and Tags

AMERICAN NATIONAL STANDARD (ANS)

ANS 253 1	(1967) Fundamental Specification of Safety Colors

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(1989) Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 449	(1993) Specification for Quenched and Tempered Steel Bolts and Studs
ASTM B 209	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 429	(1995) Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

PART 2 PRODUCTS (all products shall match those found on the As-Built Construction Drawings, As-Built Materials List, or alternatively, as described in this Part)

2.1 SIGNS

2 1.1 Substrate

Conform to ASTM B 209 for aluminum sheet plate requirements Provide caution or warning signs from aluminum plate with a thickness of at least 1 3 mm. Appropriate sign mounting hardware shall be fastened to back of substrate by rivets or welding to allow mounting of sign on post.

2.2 GATES

2.2.1 Gate Posts

Stud posts to be 3½" I.D., 4" O.D. aluminum Schedule 40 pipe

2.2.2 Locks

The gate arms shall be secured or padlocked using a slide bolt as shown in the As-Built Drawings. Padlocks shall be provided with 10 keys reading "**DO NOT DUPLICATE**." Padlocks shall have case-hardened shackles

2.2.3 Gate Frame

All frame sizes to be aluminum Schedule 40 Alloy 6063-T6 of ASTM B 429 as shown on the As-Built Drawings.

2.2.4 Anchors

Shoe base for the 4" O.D. aluminum pipe should be a permanent mold, 356 aluminum alloy casting with natural finish. Set anchor bolts per manufacturers recommendations

2.3 BENTONITE PASTE

Sodium montmorillonite clay (bentonite) from the dry granular or powder form, hydrated to a workable consistency

2.4 CEMENT GROUT

According to C-03300, Cast-In-Place Concrete

PART 3 EXECUTION

3.1 SIGN REPLACEMENT

Embedded metals shall be given a primer coat of the required paint on all surfaces before they are installed in concrete forms. Items requiring two concrete pours for installation shall be attached to the embedded anchors after the initial pour, adjusted to the proper alignment, and concreted in place with second pour.

3.2 GATE REPLACEMENT

Install gate to line and grade shown on the As-Built Drawings. Install gate in accordance with gate manufacturer's written installation instructions. Keys shall be furnished by the Contractor to the Contracting Officer or authorized Navy representative immediately after the gates are installed.

C - 02822
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referenced in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS RR-F-191	(Rev J) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification)
FS RR-F-191/1D	(Rev C) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)
FS RR-F-191/2D	(Rev C) Fencing, Wire and Post, Metal (Chain-Link Fence Gates) (Detail Specification)
FS RR-F-191/3D	(Rev C) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
FS RR-F-191/4D	(Rev C) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)

1 2 SYSTEM DESCRIPTION

This section covers the requirements for a perimeter fence to be placed around the Site 14 Landfill at CBC Port Hueneme.

The new fencing shall be fabricated and installed in accordance with standard military construction; FS RR-F-191, FS RR-F-191/1D, FS-RR-F-191/2D, FS RR-F-191/3D and FS RR-F-191/4D

1 3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2 1 PERIMETER FENCE AND ACCESSORIES

FS RR-F-191 and detailed specifications as referenced and other requirements as specified All materials shall be polyvinyl chloride (PVC) and coated "black "

3 2 1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center Provide gateposts spaced as necessary for size of gate openings. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Provide drawings showing details of gate, corner, end, and pull posts

3 2 2 Post Setting

Set post plumb. Provide concrete bases of dimensions as indicated by the Contracting Officer or authorized Navy representative. Compact concrete to eliminate voids and finish to a dome shape Allow concrete to cure a minimum of 72 hours before performing other work on posts

3 2 3 Bracing

Brace gate with a diagonal truss rod and truss tightener used as a tension member

3 2 4 Fabric

Pull fabric taunt and secure fabric to tension wire and posts Secure fabric to posts using stretcher bars, ties, or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post.

Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is maximum 2 inches above ground level Install fabric with 1 strand of spring coil tension wire on top and rail on bottom

3 3 FENCE ACCESSORIES INSTALLATION

3 3 1 Post Caps

Install post caps as recommended by the manufacturer.

3 3 2 Gates

Install swing gate to swing through 180 degrees from closed to open

3 3 3 Barbed Wire

Install four barbed wire strands with a single support extending 2 feet from the top of the fence

3 4 CLEANUP

Remove waste fencing materials and other debris from the site

END OF SECTION

C - 02922
LANDSCAPING

PART 1 GENERAL

1 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Amended through Aug 1988) Federal Seed Act Regulations (Part 201-202)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1990) Agricultural Liming Materials

1 2 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1 2.1 Delivery

1 2 1 1 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries

1 2 2 Inspection

Inspect materials when they arrive at the job site for conformity to specifications.

1 2 3 Storage

Materials shall be stored as follows. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials

1 2.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles

2 2 MULCH

Mulch shall be fibrous, cellulose mulch, containing no growth or germination inhibiting substances and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water it will form a homogeneous slurry that is capable of being sprayed to form a porous mat If possible, the mulch shall be green in color to allow metering during application Biosolids may be used as part of the mulch material Mulch shall be applied at a rate of 2,000 lbs/acre

2 3 BINDER

Binder shall be of organic origin and registered with the Department of Agriculture as an auxiliary soil chemical Binder shall not be asphalt based Binder shall be nontoxic to plant or animal life. Binder shall be applied at a rate of 120 lbs/acre

2 4 PREMIXED MULCH/BINDER COMBINATIONS

Where premixed combinations meet or exceed other requirements of this Specification, they may be used

2 5 WATER

Shall not contain a total dissolved solids level of greater than that in potable supply at the installation or exceed plant species salt tolerance for any growth regime, irrigation practice used, or local climate Water shall be applied at rate such that hydroseeding machinery operates smoothly, but that minimizes surface runoff and leaching once applied.

2 6 HYDRAULIC EQUIPMENT

Contractor shall use a commercial type mulcher to apply slurry Equipment shall have a built-in agitation system with an operation capacity sufficient to agitate, suspend and homogeneously mix slurry. Distribution lines shall be large enough to prevent stoppage and to provide even distribution of the slurry over the ground The pump must be capable of exerting up to 150 psi at the nozzle The slurry tank shall have a minimum capacity of 1,000 gallons and shall be mounted on a traveling unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste.

2 7 SOIL AMENDMENTS

Soil amendments shall consist of lime, fertilizer, organic soil amendments and soil conditioners meeting the following requirements. Soils used as topsoil shall be amended as recommended by soil test

2 7 1 Lime

Lime shall be agricultural limestone in accordance with ASTM C 602. Lime shall be applied at a rate determined by the soil test

3.2 HYDROSEEDING

3.2.1 General

Seeding at Site 14 shall be in all areas and shall cover bare topsoil and berms and shall fill cavities in paving stone. Seeding should be applied to within 1 inch of roadbeds or other impervious surfaces. Previously prepared seedbed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. When possible, use low contact pressure tires on vehicles. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution. Avoid covering underdrain outlets.

All slurry preparation shall take place on the job site. Operators of hydroseeding equipment shall be thoroughly experienced in this type of application. Obtain approval of hydroseed area preparation from the Contracting Officer or authorized Navy representative before it is applied.

3.2.2 Mixing

Water, mulch and binder shall be added to the mixing tank first. Fertilizer and seed shall be added at the last practical moment. The slurry must be completely homogeneous before it is applied.

3.2.3 Application

Apply specified slurry mix in a sweeping motion to form a uniform mat at the specified rate. Limit hydroseeding to designated areas and prevent contact with other items. Slurry mixture which has not been applied within two hours of mixing shall be removed from the site. Total time from the addition of seed to seed discharge shall be less than 1 hour, if more than 1 hour, the remainder of the load shall be recharged with seed.

3.3 BUSH PLANTING

Bushes shall be planted spaced 10 feet on center, offset +4 feet from centerline for two (2) consecutive bushes, followed by two (2) bushes offset -4 feet from centerline, and so on. The centerline shall be the centerline of the top of the western berm. Plant and stabilize bushes according to vendor's instructions. Assure that bushes will be protected from any further construction activities.

3.4 RESTORATION AND CLEAN UP

3.4.1 Restoration

Existing vegetated areas, pavements and facilities that have been damaged from the hydroseeding operation shall be restored to original condition.

3 7 2 3 Post-Fertilization

Nitrogen carrier fertilizer shall be applied at the rate of no more than 0 5 pounds per 1,000 square feet for hydroseeded areas or groundcover after the first month and again prior to the final acceptance. The application shall be timed prior to the advent of winter dormancy and shall avoid excessively high nitrogen levels

3 7 2 4 Repair

The Contractor shall re-establish as specified herein, eroded, damaged or barren areas or plants including seed and topsoil

3 7 3 5 Maintenance Report

A written record shall be furnished to the Contracting Officer or authorized Navy representative of the maintenance work performed

END OF SECTION

C - 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	(1996) Standard Specification for Structural Concrete
ACI 315	(1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1993) Concrete Aggregates
ASTM C 94	(1994) Ready-Mixed Concrete
ASTM C 143	(1996) Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	(1995) Portland Cement
ASTM C 1107	(1991) Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.2 DEFINITIONS

a "Cementitious material" as used herein shall include all Portland cement, pozzolan, fly ash, ground iron blast-furnace slag, and silica fume.

1.3 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer or authorized Navy representative

1.4 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until ready for concrete placement. Store concrete aggregates to prevent contamination or segregation. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt Provide for accurate identification after bundles are broken and tags removed.

3.2 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time to 60 minutes if the air temperature is greater than 85 degrees F. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Do not place concrete when weather conditions prevent proper placement and consolidation in uncovered areas during periods of precipitation, or in standing water.

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within forms.

3.3 SURFACE FINISHES

ACI 315 for repair and finish, unless otherwise specified.

3.3.1 Defects

Repair formed surfaces by removing minor honeycombs, pits greater than 1 square inch surface area or 0.25 inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb (including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects) that affects the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action before repairs are carried out. The surface of the concrete shall not vary more than the allowable tolerances of ACI 301. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish, unless otherwise specified.

3.3.2 Floated Finish

All concrete work shall have a floated finish. Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials.

END OF SECTION

APPENDIX D

GROUNDWATER MONITORING PLAN

APPENDIX D

GROUNDWATER MONITORING PLAN

D.1 WATER STANDARDS AND GROUNDWATER MONITORING PROGRAM

The Navy is implementing this groundwater monitoring program in accordance with the following ARARs: Title 27 California Code of Regulations Sections 20390, 20395, 20400, 20405 and 20410

D.1.1 Chemicals of Concern

Chemicals of concern (COC) detected in soils at Site 14, identified in the remedial investigation (RI), include several polynuclear aromatic hydrocarbons (PAH); the pesticide toxaphene; the polychlorinated biphenyl (PCB) Aroclor-1260; and antimony Results for groundwater samples indicate sporadic detections of volatile organic compounds (VOC), semivolatile organic compounds (SVOC), organophosphorus pesticides, and total petroleum hydrocarbons (TPH), but do not indicate a site-specific source The landfill cover significantly reduces the potential COCs in soil to leach to groundwater COCs identified in the RI shall be referred to as routine monitoring parameters this groundwater monitoring plan so as not to confuse them with COCs as defined in the ARARs for this action.

The postclosure monitoring program for Site 14 is intended to monitor off-site migration of COCs from Site 14 These COCs encompass all detected analytes associated with historical waste disposal at the site, including but not limited to COCs detected in soil and groundwater samples that cannot be attributed to on-site sources Pursuant to the Action Memorandum/Remedial Action Plan (Navy 1998) prepared for Site 14 and to 27 CCR 20420 (g), samples shall be analyzed initially for the complete list of chemicals in Appendix II of Title 40 Code of Federal Regulations (CFR) Part 258.55 (Subtitle D), including VOCs, SVOCs, pesticides and PCBs, and metals, plus total recoverable petroleum hydrocarbons, TPH as gasoline, and Vapam. This complete list of analytes includes all constituents that could be attributed to Site 14 disposal activities, whether detected historically or not, and are referred to as COCs in this monitoring plan.

In subsequent years, samples will be analyzed for the same chemicals except that 40 CFR 258 55 Appendix II will be replaced by 40 CFR 258 54 Appendix I constituents and undetected constituents will be dropped from the program.

Existing monitoring well S14-MW01 and proposed monitoring wells S14-MW18 and S14-MW19 shall function as the upgradient background monitoring wells for groundwater flowing into Site 14. The well locations are shown on Figure 5-2. The wells are screened within the semiperched aquifer and shall provide samples of groundwater unaffected by Site 14 contaminants

The detection monitoring network for Site 14 consists of five monitoring wells and includes existing wells S14-MW02, S14-MW03, and S14-MW04, and two proposed wells (S14-MW16 and S14-MW17). The locations of detection monitoring wells are shown on Figure 5-2. Well S14-MW02 is screened within the semiperched aquifer at 0.7 feet amsl to –14.3 feet amsl, and wells S14-MW03 and S14-MW04 are screened at 3.34 feet amsl to –11.66 feet amsl. The two proposed monitoring wells shall be installed at similar depths. The detection monitoring wells provide downgradient points to monitor groundwater as it exits Site 14. The proposed wells provide coverage along the western and eastern segments of the downgradient boundary of the site that are not covered by existing wells

Evidence presented in the RI (PRC 1997) indicates that soil contaminant sources at Site 14 have not migrated to groundwater because contaminants in soil were not found in groundwater. The landfill cover renders unlikely the possibility that contaminants in soil will leach to groundwater. The use of existing and proposed wells is considered adequate for postclosure monitoring of groundwater at Site 14 and complies with the ARAR, 27 CCR 20420

D.1.5 Monitoring Well Performance Standards

Existing wells at Site 14 proposed for postclosure monitoring are constructed of 4-inch diameter schedule 40 polyvinyl chloride (PVC) casing and screen in accordance with the criteria presented in 27 CCR 20415 (b)(4). The screens on each well are 15 feet long and cross the water table. This position allows monitoring of light nonaqueous phase liquids (LNAPL) as well as dissolved constituents within the semiperched aquifer. The annulus of each well is backfilled with standard materials, including a sand filter pack to a depth of 1 to 2 feet above the screen, a 3-foot bentonite pellet seal, and a cement-bentonite grout seal to the surface. Each well has been developed and the tops of each casing have been surveyed to a common datum. Four quarters of monitoring data, at a minimum, are available from these wells (PRC 1997). Well information is summarized on Table D-1. Appendix D-1 contains boring and well construction logs for existing wells. Proposed wells shall be constructed in a similar manner, using similar materials as the existing wells. Logs of proposed wells shall be available when wells are completed by TtEMI. A special sampling frequency and regimen (start-up monitoring) for new monitoring wells is not projected because similar data are available for the existing monitoring wells in very close proximity

TABLE D-1

MONITORING WELL DATA

Well	Top of Casing (feet amsl)	Boring Depth (feet bgs)	Casing Diameter (inches)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Well Depth[2] (feet below top of casing)
S14-MW01	7.74	20.5	4	3.5	18.5	20.15
S14-MW02	4.20	20.0	4	3.5	18.5	18.48
S14-MW03	7.44	25.0	4	4.1	19.1	20.24
S14-MW04	7.30	25.0	4	4.4	19.4	20.23
S14-MW016[1]	–	–	4	–	–	–
S14-MW017[1]	–	–	4	–	–	–
S14-MW018[1]	–	–	4	–	–	–
S14-MW019[1]	–	–	4	–	–	–

Notes:

[1] Proposed detection or background monitoring wells These wells shall be 4-inch-diameter.
[2] Otherwise known as sounded casing depth Casing depths measured in the field in 1997 during basewide groundwater investigation
– Wells not yet installed
amsl Above mean sea level
bgs Below ground surface

Four 4-inch-diameter monitoring wells shall be installed in the semiperched aquifer Well materials and construction procedures shall comply with State of California Department of Water Resources guidance documents and regulations

Screen and casing materials shall be constructed of flush-threaded Schedule 40 PVC pipe. The well screens shall be factory-slotted with a slot width of 0 020 inches The bottom of the well screen shall be fitted with a flush-threaded end cap and silt trap Rubber O-ring seals shall not be used in the screen and casing joints. The screen and casing shall be decontaminated at the point of manufacture and delivered to the site sealed in plastic. PVC glues or solvents shall not be used in the well construction process

Monitoring wells shall be installed so that 3 to 4 feet of screen shall be above the high water level anticipated from seasonal and tidal fluctuations The exposed screen will allow for floating product or LNAPLs within the aquifer to enter the well under static conditions regardless of seasonal or tidal fluctuations

In situations where the static water level is very shallow, the length of well screen exposed above the static water level may be modified along with the amount of filter pack above the screen to ensure an adequate seal of the borehole annulus above the well screen

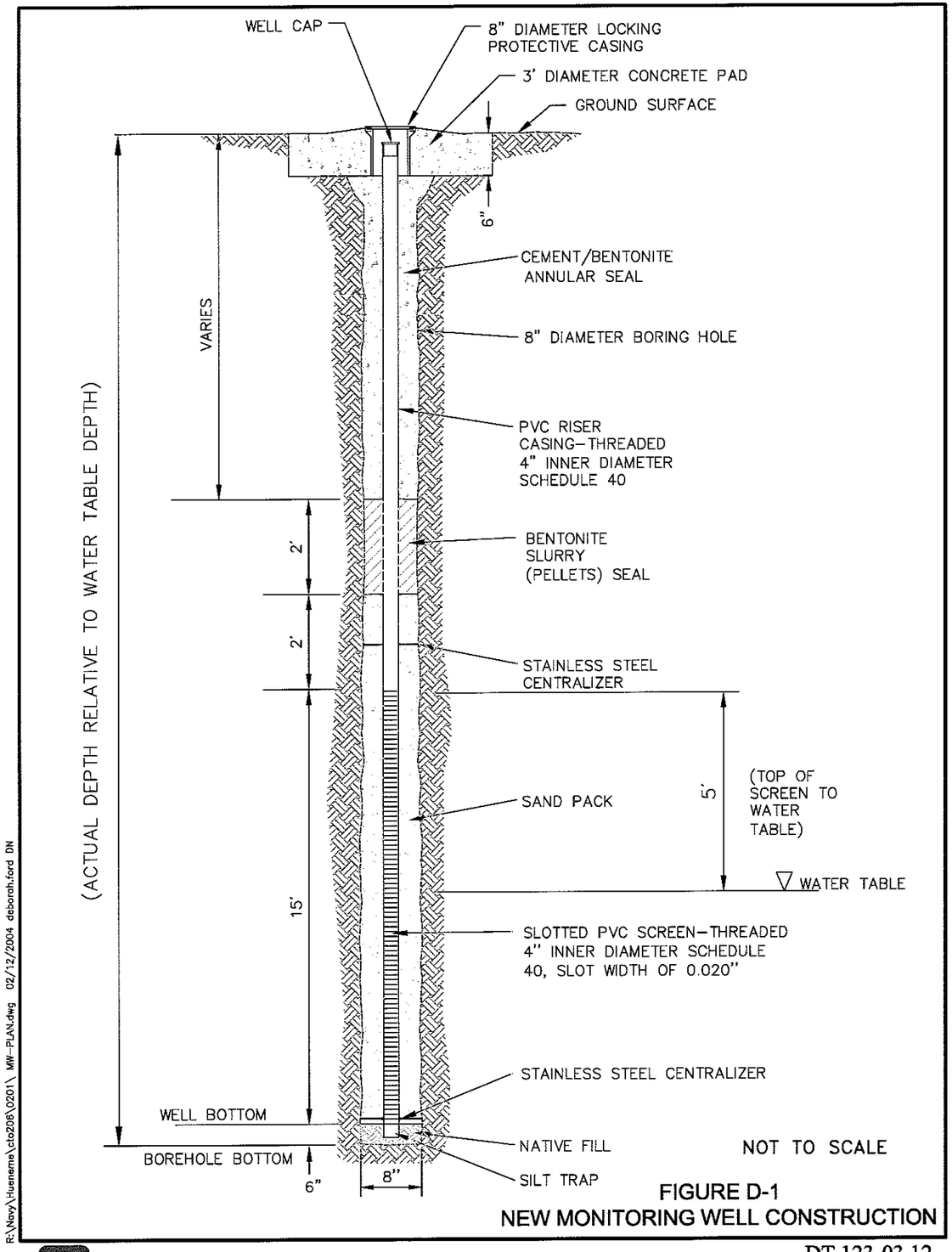


FIGURE D-1
NEW MONITORING WELL CONSTRUCTION

DT 123-03.12

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Tetra Tech EM Inc.

D.1.5.2 Well Development

Each completed monitoring well shall be initially developed no sooner than 48 hours after the grout seals are placed Wells shall be developed first by bailing, swabbing, or surge block to produce a pumping effect within the saturated screen sections A bailer shall be used to remove any sediment accumulated at the bottom of the well until less than 1 percent of the saturated screen length contains sediment Additionally, wells may be pumped with an electric submersible pump to further enhance communication with the surrounding aquifer Wells shall not be developed using compressed air, acids, or chemical dispersion agents

The amount of water purged from each well during well development shall be a minimum of three times the amount introduced into the borehole during well drilling and construction, plus three additional borehole volumes The borehole volume of the well shall include the volume of water within the well casing, plus the calculated volume of the saturated filter pack, assuming a porosity of 30 percent The water may be removed from the well by using either a stainless-steel or PVC bailer or a submersible pump If a high-capacity pump such as an electric submersible turbine unit is used during well development, the intake of the pump shall be repeatedly raised and lowered throughout the saturated screen interval of the well during pumping

Throughout the purging process, temperature, specific conductance, pH, and turbidity shall be measured periodically The well shall be considered adequately developed when these parameters have stabilized within a range of 10 percent between successive measurements, the minimum volume of water has been removed, and the water is visibly clear of sediment If these requirements for development, with the exception of turbidity, have been met, two more borehole volumes of water shall be removed and well development shall be considered complete

If a well exhibits slow recharge, the well shall be surged again with a swab or surge block in an attempt to enhance hydraulic communication with the surrounding aquifer If, after additional well development, the well recharge rate does not improve and the minimum required quantity of water from the well is not obtained, a maximum of 4 hours shall be spent developing the well Purged development water shall be properly contained and disposed of in accordance with the investigation-derived waste (IDW) management plan, as described in Section D 2 6 All development equipment shall be decontaminated between well borings by use of a steam cleaner in a designated decontamination area or by washing with a phosphate-free detergent after it is retrieved from the well, then rinsing in distilled, deionized water

and fall (Table 5-1) Accordingly, water level measurements shall be recorded in February or March to coincide with the high water table and in October to coincide with the low water table

The water level for all wells shall be measured before presample purging of any wells occurs Water levels must be measured and samples collected at the background wells first, followed by detection wells All information collected in association with water level measurement and groundwater sampling shall be recorded on the appropriate forms and in the field logbook (Section D.2.3)

The initial steps associated with water level measurement are removing the protective well cap and casing cap, and checking the breathing zone for organic vapors using a photoionization detector (PID). If breathing zone vapors at concentrations greater than 5 parts per million (ppm) are encountered, the sampling team must leave the well and don the appropriate level of personal protective equipment (PPE) before continuing Powderless surgical gloves shall be worn during water level measurements and shall be changed between wells Action levels and appropriate PPE must be specified in the site-specific health and safety plan provided by the contractor that collects the samples. The PID must also be used to survey vapors inside the well casing PID readings, as well as general observations of the appearance and condition of the well casing and protective outer casing, must be recorded in the logbook and on the groundwater sampling data sheets.

To measure the water level in the casing, the probe must be lowered into the casing until the light or sound alarm is activated, indicating that the probe has touched the water surface. Before the water level is measured, the tape must be physically compared with a yardstick to verify that it has not been cut or altered and that the tape reading shall be accurate The static water level must be read directly by holding the tape to the permanent mark at the top of the PVC well casing and reading off the depth to the nearest 0 01 feet The probe must be raised and lowered two more times to obtain two more measurements; then, the three readings must be averaged and recorded in the logbook Next, the probe must be lowered until it encounters resistance, indicating it has reached the bottom of the well casing The depth must be read off the tape and recorded in the logbook It may be necessary, depending on the design of the water level indicator, to add the length of portion of the probe that extends below the sensor to obtain the correct bottom depth.

If the presence of an immiscible layer is indicated by discoloration of the tape or by odor or past analytical results, the depth to water shall be confirmed with a measurement using an interface probe This measurement shall be collected before the well is purged.

The water level indicator shall be decontaminated between wells by washing the probe and tape with a phosphate-free detergent after they are retrieved from the well and then rinsing them in distilled, deionized water. Wash and rinse water must be emptied into a wastewater container before proceeding to the next well

The equipment required for water level measurement includes:

- Electric water level indicator (probe)
- Oil/water interface probe
- Logbook
- Well keys
- Decontamination equipment (tubs or buckets, brushes, phosphate-free detergent, distilled deionized water, wastewater container)
- PID
- Powderless surgical gloves

D.2.2 Sample Collection and Field Analytes

Groundwater shall be sampled and field analytes shall be monitored in conjunction with water level measurements to coincide with high and low water tables See Section D 1 6 and Table D-2 for a description of analytes, sampling frequencies, reporting units, and analytical methods

After the water level and bottom of well casing have been measured (Section D 1 1), the casing volume shall be calculated The volume of water inside the well casing is calculated by subtracting depth to groundwater from total depth of well casing and multiplying the height of water in the casing by 0 65 gallons per foot (for a 4-inch inner diameter well)

A minimum of three times the volume of water inside the well casing shall be removed with a disposable bailer or pump (presample purging) Water shall be discharged from the bailer or pump to a calibrated bucket with volumes marked in increments of gallons or fractions of gallons A sample of purge water shall be discharged into a beaker or other container after each casing volume is removed from the well for measurement of field analytes The remaining purge water shall be emptied into a wastewater container (such as a 55-gallon drum)

- Vapam
- Dissolved metals
- Hexavalent chromium

This sample order is determined largely by the volatility of the target constituent, with the most volatile sampled first. Analyses that require preservatives (with the exception of VOCs) are listed last in order to avoid cross-contamination of sample containers with preservatives, which may affect results for sulfate and nitrate.

The sample for analysis of dissolved metals shall be collected in an unpreserved sample container, then transferred with a peristaltic pump through a 0.45-micron filter to a container with preservative.

TABLE D-3

SAMPLE CONTAINERIZATION

Parameter	Containerization/Preservation	Holding Time+
Total dissolved solids (TDS)	1-liter poly or glass/4°C	7 days
Chloride*	1-liter poly or glass/4°C	48 hours
Sulfate*	1-liter poly or glass/4°C	48 hours
Nitrate	500-milliliter poly or glass/H_2SO_4 top H <2/4°C	48 hours
Alkalinity (includes carbonate and bicarbonate)*	1-liter poly or glass/4°C	14 days
VOCs	Three 40-mL vials with teflon septum/HCl/4°C	14 days
SVOCs	Two 1-L amber glass with teflon cap/4°C	7 days/40 days++
Chlorinated herbicides	Two 1-L amber glass with teflon cap/4°C	7 days/40 days++
Vapam	As required by laboratory	
TRPH	Two 1-L amber glass H_2SO_4 with teflon cap/4°C	28 days
TPHE – diesel & JP-5	Two 1-L amber glass with teflon cap/4°C	7 days/40 days++
TPHP – gasoline	Two 40-mL VOA vials with teflon septum/HCl/4°C	14 days
Organophosphorus pesticides/PCBs	Two 1-L amber glass with teflon cap/4°C	7 days/40 days++
Total organic carbon	500- mL amber glass/H_2SO_4 to pH <2/4°C	28 days
Dissolved metals**	1-L poly HNO_3 to pH <2/4°C	6 months
Hexavalent Chromium**	500 mL plastic bottle/4°C	24 hours

Notes:

Bottles must be provided by the analytical laboratory. The analytical laboratory's container requirements may differ slightly from above.

* May share sample container.
** Filtration for dissolved analysis with 0 450-micron filter prior to preservation.
+ Holding times are for methods listed in table only.
++ Indicates holding time for extraction and analysis

SVOC Semivolatile organic compound
VOA Volatile Organic Analysis
VOC Volatile organic compound
TPHE Total petroleum hydrocarbons extractable
TPHP Total petroleum hydrocarbons purgeable
TRPH Total recoverable petroleum hydrocarbons

The filter shall be disposed of afterwards and a new filter shall be used for the next dissolved metals sample. Flushing the filter is not necessary.

In addition to sample labels, field sampling requires other forms of documentation. This additional documentation is necessary to provide an accurate record of sampling events and field observations. This information shall be recorded in field logbooks, groundwater sampling data sheets, and chain-of-custody forms Example forms are provided in Appendix D-3.

Documentation shall be completed legibly in ink. Errors shall be crossed out with a single line, dated, and initialed by the field team member who records the information. Unused portions of logbook pages shall be crossed out, and each page shall be signed and dated by the field team member who made the entry

D.2.4 Sample Shipment and Chain of Custody

After samples are collected, labeled, and sealed, they shall be placed in iced coolers. Inert packing materials (such as vermiculite) shall be placed around sample containers to prevent breakage. Sample coolers must be kept in the sampler's custody at all times possible. When that is not possible, coolers shall be stored in a locked vehicle or on-site facility until they are shipped to the analytical laboratory

Chain-of-custody forms shall be completed for all samples. Before the coolers are shipped, the field sample custodian shall sign the chain-of-custody form. When possible, the courier receiving the samples should also sign the form. A copy of the chain-of-custody form shall be retained for the project files. After the chain-of-custody form has been completed and signed, it shall be inserted in a sealed plastic bag and taped inside the lid of the cooler. The cooler shall be sealed with a custody seal (signed by the field sample custodian), so that the seal will be broken to remove the samples. The field chain of custody terminates when the laboratory receives the samples At that time, the laboratory assumes responsibility for custody. When it is received at the laboratory, a laboratory representative shall inspect the contents of the cooler, sign the chain-of-custody form, and list the date and time of receipt

D.2.5 Quality Control Samples

The quality assurance and quality control (QA/QC) program for postclosure groundwater monitoring at Site 14 shall be detailed in a quality assurance project plan (QAPP) to be prepared by the maintenance contractor QA/QC field samples shall be collected to evaluate whether data quality has been affected by field activities or other outside events. QA/QC field samples include duplicates, equipment blanks, and trip blanks. Additional sample volumes shall also be collected for matrix spike and matrix spike duplicate (MS/MSD) samples.

The drums shall be labeled to indicate the date and time of collection, sampling location, sampling personnel, and waste media, and placed on wooden pallets IDW shall be transported off site for disposal at a licensed facility, in accordance with federal and state regulations and based on analytical results.

Each drum shall be assigned a unique identification number, and field personnel shall track in the field logbooks the IDW deposited in each bin Information recorded in the logbooks shall include the boring or well identification, depth from which soil was collected, date of generation, and moisture content (saturated or unsaturated) Each drum shall be labeled with the dates of soil or groundwater collection and its identification number A waste tracking form indicating the date, type, and quantity of IDW generated shall be completed and provided to NBVCPH.

Environmental groundwater samples will provide data that can be used to characterize waste collected in drums during the Site 14 investigation. The IDW contractor shall collect samples of soil IDW for waste characterization. The IDW disposal contractor may choose to collect representative samples of IDW groundwater or decontamination waste water before disposal, as needed, for waste characterization. Results of the laboratory analyses shall be used to characterize the contained waste to select the most cost-effective disposal methods

IDW shall be either disposed of or remediated based on waste profiling using environmental sample results and waste-profile samples. Soil classified as nonhazardous shall be spread on site at a location specified by NBVCPH or transported to a licensed facility for disposal as nonhazardous material. Soil that contains hazardous material shall be properly labeled and disposed of in accordance with the waste management plan

Wastewater that is considered nonhazardous shall be disposed of in a manner that will not result in erosion or flood damage Water that is considered hazardous shall be properly labeled and remain stored near the well until it is disposed of properly Any solidified grout waste shall be disposed of properly. Wastewater from cleanup of grouting equipment shall be disposed of on site in accordance with the "California Stormwater Best Management Practice Handbook" (California Stormwater Quality Taskforce 1993).

D.2.7 Laboratory Analysis and Data Validation

Table D-2 lists the COCs, the monitoring frequency, and the analytical methods that shall be used Constituents shall be monitored at the frequency on Table D-2 for detection and background monitoring wells In addition, Table D-2 lists field analytes to be monitored as part of the postclosure monitoring program.

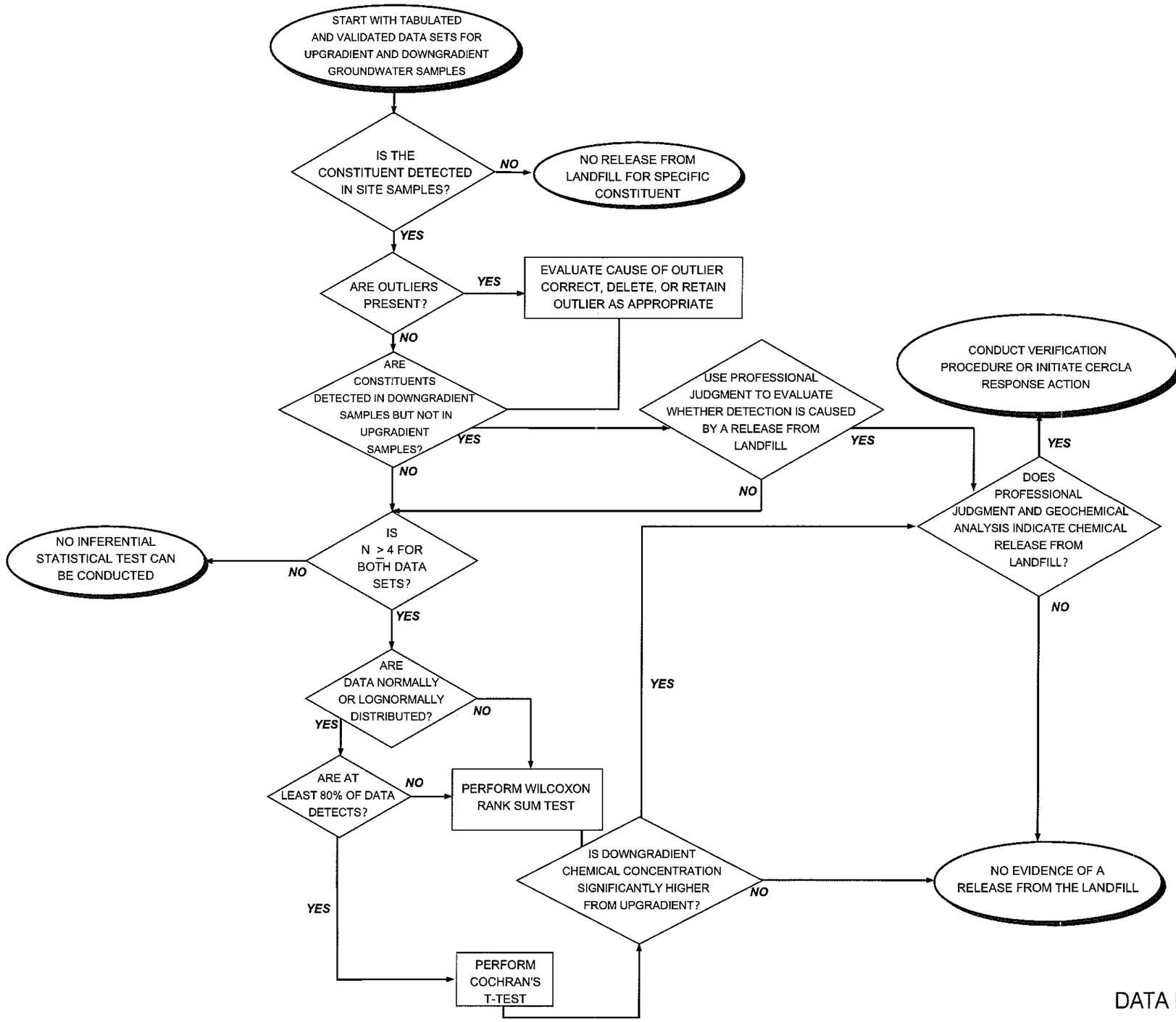

FIGURE D-2
DATA EVALUATION FLOW CHART

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The review of data quality shall include the validator's report on data quality and detections of any constituents in blank or other QA/QC samples The data shall also be examined for any other errors Any data quality issues that may affect the outcome of statistical tests shall be noted The representativeness of the results shall also be reviewed and described

Data shall be tabulated in a format that presents all ID numbers, dates of sampling, chemical names, results, units of measure, and data qualifiers (if any) for all analyses Separate tables shall be generated for site and background data sets

D.3.2 Outlier Evaluation

No data evaluation would be complete without assessing data sets for the presence of outliers Outliers are extreme (high or low) values that are notably divergent from the main body of data (Gad and Weil 1989) According to EPA (1998), outliers may result from transcription errors, data-coding errors, instrument breakdowns, calibration problems, and power failures, or they may reflect greater variability in the population than was expected Outliers that arise as a result of the natural and inherent spatial or temporal variability of the chemical must not be discarded; in fact, no outlier must ever be discarded based solely on the results of a statistical test (EPA 1998) Outliers can, however, disproportionately affect the statistical descriptors of the data set; biasing the mean and standard deviation toward the outlier datum Therefore, it is important to identify outliers in both background and site data sets, and to treat all outliers appropriately

Outliers can be identified by visual inspection of data using statistical graphs such as the normal probability plot, by a large increase in the standard deviation (especially if the data set is small, as is the case with this monitoring program), or through the use of specific tests (for example, Dixon's test [EPA 1998]) However, because one outlier may mask another, Dixon's and other tests may not identify an outlier (Gilbert 1987), so graphical review of the data is always a critical component of outlier assessment Professional judgment shall be used with the above techniques in the identification, evaluation, and treatment of outliers Once they have been identified, outliers shall either be corrected, discarded, or retained

Outliers that are obvious mistakes shall be corrected when possible Outliers that are not obvious mistakes shall be reviewed to evaluate the cause The outlier shall be discarded if the cause is identified as a transcription error, field or laboratory contamination, matrix interference, or is the result of instrument calibration problems If no artificial cause for the outlier can be identified, the outlier shall be taken to represent natural variability and shall be retained in the data set for statistical testing However, statistical testing may be conducted with the outlier both present and absent from the data set to assess its effect on the outcome of the statistical test

D.3.3 Statistical Tests

In general, statistical tests can be defined as either parametric or nonparametric tests. A parametric test assumes that the data are normally (or lognormally) distributed. A normal distribution has specifically defined characteristics (Gilbert 1987) and follows the familiar bell-shaped curve. The Student's t-test is an example of a parametric test; however, for this investigation, Cochran's t-test (which makes an adjustment for unequal sample sizes and unequal variance) shall be used. Cochran's t-test shall be applied for constituents that are normally or lognormally distributed (in both site and background data sets), as long as the detection rate is greater than or equal to 80 percent in each data set.

A nonparametric test "does not depend for its validity on the data being drawn from a specific distribution" (Gilbert 1987) and is, therefore, a "distribution-free" technique. Nonparametric tests recommended by Navy guidance (1999) include the Wilcoxon Rank Sum (WRS), Gehan Wilcoxon (Gehan), slippage, and quantile tests. These tests may be validly applied regardless of data distribution. The WRS test shall be used if the detection rate is less than 80 percent, but greater than 50 percent, or if the data follow a nonparametric distribution.

Statistical comparison tests shall be calculated only for chemicals that are detected in samples collected from both site and background monitoring wells. Constituents detected in site samples but not detected in background samples, shall be evaluated using professional judgment (the step after the statistical tests in Figure D-2) to assess whether the detection represents a release from the site or if some other plausible cause exists. The remainder of this section describes normality testing, handling of nondetections, statistical hypothesis testing, Cochran's t-test, the WRS test, and the slippage and quantile tests. All inferential statistical tests shall be calculated at a level of significance (p-value) of 0.05 (0.95 confidence level).

Selection of statistical tests for site-to-background comparisons depends upon the characteristics of each data set. The number of samples, detection rate, variance, and data distribution must be evaluated to apply the most appropriate statistical tests. For this study, inferential statistical tests shall be applied using data for 1 year of quarterly samples. These statistical tests (referred to as "two-sample" tests) may only be applied if the constituent is detected at "sufficient" (as defined in Navy and EPA guidance documents, and specified above) frequency in both the site and background samples. According to EPA (1998) and Navy (1999) guidance, several parametric and nonparametric tests may be used, depending on detection frequency and characteristics of the data set.

D.3.3.1 Normality Testing

Determining whether the distribution of data is normal or lognormal, or that there is no underlying distribution, is necessary in selecting the appropriate statistical test Normal or lognormal distributions are usually evaluated with parametric statistical tests. Nonparametric tests are usually applied to data with no underlying distribution This section presents the Shapiro-Wilk W test; however, other tests for normality or graphical evaluations may be used to determine the distribution of data. Data distributions may also be qualitatively evaluated using normal and lognormal probability plots, but the W test described here provides a quantitative measure of the degree of departure from perfect theoretical normal and lognormal distributions.

The W test, developed by Shapiro and Wilk (1965), can be used to determine whether the data distribution is normal, lognormal, or random This test is appropriate for sample populations of less than 25, but an extended version accommodates larger sample sizes The null hypothesis (H_o) to be tested is that the population has a normal distribution The alternative hypothesis (H_a) is the population does not have a normal distribution The W test, as presented in Gilbert (1987), is conducted as follows:

$$d = \sum_{i=1}^{n} (x_i - \bar{x})^2 = \sum_{i=1}^{n} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)^2$$

1 Compute the denominator d of the W test statistic, using the n data

2. Order the n data from smallest to largest to obtain the sample order statistics.

$$x_1 < x_2 < \quad < x_n$$

3 Compute k, where

$$k = \frac{n-1}{2} \text{ if n is odd}$$

4. Use Table A6 of Gilbert (1987) and for the observed n find the coefficients a_1, a_2, , a_k

5. Then compute

$$W = \frac{1}{d}\left|\sum_{i=1}^{k} a_i \left(X_{[n-i+1]} - x_{[i]}\right)\right|^2$$

6. Reject the null hypothesis (H_o) at the desired significance level α if W is less than the quantile listed in Table A7 of Gilbert (1987)

If H_o is accepted, the data are normally distributed. If H_o is rejected, the data must be logtransformed (either natural or base-10 logs) and the W test must be applied to the logtransformed data. If H_o is then accepted, the data are distributed lognormally. If H_o is rejected while using this test on the data and the log data, the data are considered to have no underlying distribution (that is, the data are nonparametric).

D.3.3.2 Handling Nondetections

Many environmental data sets contain analytes that are not positively detected in every sample collected and analyzed. In some cases, the data set shall generally represent a mixture of detected and nondetected results for a particular chemical; in other cases, all or none of the samples may contain positively detected chemicals. A nondetected, or censored, result is usually reported as a sample quantitation limit (SQL). An SQL indicates that the chemical could not be detected above a particular concentration, which is sample-specific (that is, the calculated SQL may vary from sample to sample). The nondetected chemical may be present at a concentration below the reported quantitation limit, or it may not be present in the sample at all.

During evaluation of detection monitoring and background groundwater data, one-half the SQL shall be used in statistical testing as a starting point. EPA risk assessment guidance (1989) recommends using one-half the SQL for all nondetected results. Other guidance (EPA 1998) advocates the use of simple substitution in data sets where the chemical is detected in at least 85 percent of the samples, and use of an alternate method if the detection rate for a chemical is less than 85 percent. In any case, the uncertainty in the value of statistical quantities (such as mean, standard deviation, and others) and in the results of statistical tests increases as the detection rate decreases. The effect of substituted values for nondetections shall be taken into account using professional judgment.

D.3.3.3 Statistical Hypothesis Testing

Statistical hypotheses are framed in terms of a null hypothesis (H_o) and an alternative hypothesis (H_a). For example, the null hypothesis may state, "chemical concentrations in groundwater samples collected from site monitoring wells do not exceed background concentrations." In this case, the alternative hypothesis would be, "chemical concentrations in groundwater samples collected from site monitoring wells do exceed background concentrations." In setting up the hypotheses for testing, the tolerable limits on decision errors must be specified based on the consequences of making decision errors. There is always uncertainty when dealing with a sample population, so these limits can never be zero.

Decision errors may be described as Type I or Type II errors In a Type I (false positive) error, the null hypothesis is rejected, when in fact it is true In a Type II (false negative) error, the null hypothesis is accepted, when in fact it is false To set these probability limits on decision errors, α (level of significance) and β (complement to the power) must be specified, as in the following example:

- $1-\alpha$ is the confidence level, whereas α is the significance level So, at 90 percent confidence, α is set at 0 1
- $1-\beta$ is the power of the test, whereas β is the complement to the power So, at 80 percent power, β is set at 0 2

For the statistical hypotheses tested for this study, the α and β to be selected shall depend upon the attributes of the data sets and the tolerable decision errors that are acceptable to the decision-makers The various statistical tests that may be applied and the hypotheses to be tested are described in more detail below

"Two-sample" tests are used to compare two data sets (for example, site versus background data), rather than to compare two samples (as the name may imply) These tests include both parametric and nonparametric tests Two-sample parametric tests include Cochran's t-test (described in Section D 3 3 4) Nonparametric tests include the Wilcoxon Rank Sum or Mann Whitney U-test, the Gehan test, the quantile test, and the slippage test The Wilcoxon Rank Sum, Mann Whitney U-test, and the Gehan test compare the median values of two data sets, whereas the quantile and slippage tests examine the data values in the upper portion of the distribution of the two data sets

D 3.3.4 Cochran's t-Test

Cochran's t-test is a modified Student's t-test that is appropriate to use when the variances in the data sets are heterogeneous and sample sizes are unequal The criteria of normality, independence of data, complete frequency of detection, and appropriate sample size must also be met for this test to be used A frequency of detection between 80 and 100 percent is allowed; for data sets with detection frequencies less than 80 percent, nonparametric tests shall be applied (see following section)

The observed test statistic for the Cochran's t-test is calculated using the equation:

$$t_{obs} = (\bar{x}_1 - \bar{x}_2)/(W_1 + W_2)^{0.5}$$

where:

$\bar{x}_1$ = the mean of the first data set

$\bar{x}_2$ = the mean of the second data set

W_1 = the variance of the first data set divided by the sample size of the first data set

W_2 = the variance of the second data set divided by the sample size of the second data set

The t_{obs} value is compared to the expected t value (t_{exp}), which is calculated using the equation:

$$t_{exp} = (t_1 W_1 + t_2 W_2)/(W_1 + W_2)$$

where:

t_1 = t-value for the first data set taken from the t distribution table at the appropriate degree of freedom and level of significance

t_2 = t-value for the second data set taken from the t-distribution table at the appropriate degree of freedom and level of significance

The t_{obs} value is compared to the t_{exp} value; if the absolute value of t_{obs} is lower than t_{exp}, then there is no statistical difference between the two groups The data indicate a possible chemical release if t_{obs} is greater than t_{exp} and the mean of the site data is greater than the mean of the background data

D.3.3.5 Wilcoxon Rank Sum Test

The WRS test is a nonparametric version of the t-test that compares the median concentrations of two data sets The results of the WRS test indicate when the median concentration for one population is higher or lower than the median concentration for a second population Sample sizes need not be equal to apply this test; however, the WRS test is somewhat sensitive to nondetected data. The WRS test can handle a moderate number of nondetections by treating them as ties (equal in rank) (Gilbert 1987). However, this test may be weakened if different SQLs are given for different results

The WRS test is conducted by first ranking the data, from smallest to largest, for the combined data set that contains both site and background data. Rank values are then assigned to each data point, starting with one for the lowest value and continuing until all data points have been assigned a corresponding rank. The ranks of the site data are then summed and compared with an acceptance range corresponding to a particular level of

significance (p-level = 0.05) and the sample sizes of the site and background data sets. If the sum of the ranks falls within the acceptance region, then the null hypothesis (that the site and background data are similar) is not rejected. If the rank sum exceeds the range, then the chemical concentrations in the two populations are statistically significantly different (Gilbert 1987, 1993). Tables found in Remington and Schork (1985) present the critical values for this test.

The WRS test can be used even when some data points are tied (equal in rank). In that case, the tied values are each assigned the mean value of the tied ranks. For example, if three data points were equal and corresponded to the ranks of 3, 4, and 5, each of the data points would be ranked as 4 (Gilbert 1987, 1993). The next largest data point would be ranked 6. However, if the number of tied ranks becomes large, the WRS test may not provide accurate results.

D.3.3.6 Quantile and Slippage Tests

If either median of the two data sets appears equivalent but there are unresolved questions about some site data in the upper percentiles of the distribution, the quantile test may be applied. The quantile test is complementary to two-sample tests that make inferences about population means or medians in that it examines only the upper proportion of the two populations being compared. The quantile test is used in conjunction with a test such as the WRS, and examines shifts in the upper tails of the two data sets. This test has the power to detect shifts in the upper tail that may not be detected by the WRS tests. The quantile test can accommodate a fairly large percentage of nondetected values because it ignores the low end of the data distribution.

The slippage test is similar in function to the quantile test in that it assesses a shift (slippage) in the upper tails of the two data sets being compared. For the analytical chemistry data, this test evaluates the potential for some of the site data to be greater than the maximum ambient datum, and is used in conjunction with a test (such as the t-test, WRS, or Gehan) that examines shifts in mean or median concentrations in the two data sets. This test is based on the maximum observed concentration for a datum in the ambient data set and the number ("n") of site results that exceed that maximum ambient concentration (Gilbert and Simpson 1990). The result of the slippage test is the probability of that "n" site samples being more extreme than the ambient data by chance alone. The test takes into account the numbers of samples in each data and determines the probability that the results for "n" samples will exceed the ambient level if the two data sets came from identical distributions. Because the slippage test focuses on the upper tails, it can accommodate a fairly large percentage of nondetections. This test is applicable only when there is at least one site datum larger than the maximum value measured in the ambient (or background) data set. The slippage test can be modified to evaluate the lower tail of the site distribution for toxicity test results.

D.3.3.7 Professional Judgment

No statistical test or comparison alone can identify a release with absolute confidence. Identifying a release requires a combination of more than one statistical test and professional judgment Any concentrations of site chemicals that differ from background concentrations (rejection of H_o) shall be subject to professional judgment— in light of the geologic, hydrologic, and geochemical characteristics of the investigation area— before the investigation concludes that a release from the landfill has occurred

Professional judgment shall be applied to prevent the conclusion that there is a statistically significant difference and represents a release that is not a result of waste disposal at the site, when there is not (a false positive or Type I error) Professional judgment shall always be accompanied by a plausible explanation Factors that may cause a constituent to be identified as statistically different from background, although not a result of waste disposal, include the effect of nondetections in the statistical test, Type I error rates, spatial and temporal variations in the distribution of constituents, and off-site activities (for example, pesticide, herbicide, or insecticide applications in areas adjacent to the site) Professional judgment shall also be applied to detections in samples from site monitoring wells when the constituent is not detected in samples from background wells

D.3.3.8 Verification Procedure

Verification samples shall be collected if statistically significant evidence of a release is not rejected by professional judgment Only site monitoring wells for which sample data indicated a release shall be resampled; however, if the next sampling event takes place before a suspected release is identified, these newly collected data shall be used During verification sampling, duplicate samples for analysis of anthropogenic constituents that were detected in samples from site monitoring wells, but not in background monitoring wells, must be collected Results from resampling of site wells shall be compared with existing background data for a constituent that may have been released The same data evaluation and statistical tests described previously shall be applied to the new data

REFERENCES

California Stormwater Quality Taskforce 1993 California Storm Water Best Management Practice Handbook, Municipal Handbook Stormwater Quality Task Force, Sacramento, CA

Dixon, W J 1953 Processing Data for Outliers Biometrics 9:74-89

Gad, S C and C S Weil 1989 Statistics for Toxicologists In Principles and Methods for Toxicology, Second Edition (Ed: A Wallace Hayes) Raven Press Ltd New York

Gilbert, R O 1987 Statistical Methods for Environmental Pollution Monitoring Van Nostrand Reinhold, New York

Gilbert, R O 1993 Letter Report to Beverly Ramsey, Battelle National Laboratory July 30

PRC Environmental Management, Inc (PRC) 1997 Final Remedial Investigation Report, Sites 9, 14, 17, and 21, NBVCPH Port Hueneme, Port Hueneme, California May 23

Remington, R D and M A Schork 1985 Statistics with Applications to the Biological and Health Sciences Second Edition Prentice Hall, New Jersey

Shapiro, S S and M B Wilk 1965 An Analysis of Variance Test for Normality Journal of the American Statistical Association 67:215-216

U S Environmental Protection Agency (EPA) 1989 Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A), Interim Final EPA/5401/1-89/002 Office of Emergency and Remedial Response December

EPA 1998 Guidance for Data Quality Assessment EPA QA/G-9 Final EPA/600/R-96/084 January

U S Department of the Navy (Navy) 1998 Action Memorandum/Remedial Action Plan for Removal Action at the Naval Construction Battalion Center, Site 14 Former Earth-moving Training Area, Port Hueneme, California January

Navy 1999 Handbook for Statistical Analysis of Environmental Background Data July

APPENDIX D-1

BORING LOGS AND WELL CONSTRUCTION LOGS

The Earth Technology Corporation

BOREHOLE LOG

Project Name: Site Inspection Study, NCBC Port Hueneme			
Project Number: 89-652	Borehole Number: S14-W1		Sheet 1 of 1
Borehole Location: Site 14		Elevation and Datum: —	
Drilling Company: Layne Western	Driller: Mark Westhoff	Date Started: 11/18/88	Date Finished: 11/18/88
Drilling Equipment: CME 75		Total Depth (feet): 20.5	Depth to Bedrock (feet): —
Drilling Method: HSA		Borehole Diameter: 10"	
Drilling Fluid: none		Depth to Water (feet): First: 6	Comp.: 7.5 24 hrs.
Completion Information: Completed as monitoring well S14-W1		Logged By: M. Powell	Checked by: V. Dale

Depth (feet)	Description	Lithology	OVA (ppm)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Drilling Rate/Time	Remarks
0	0-4" Asphalt						12:30	Start OVA down, proceeding in Land "C"
	4'-6' Silty fine sand, well graded micaceous, brown, moist, (SM).	SM	—	1		6-6-7	12:45	
5	6'-9' Fine sand, some silt, micaceous, brown, wet, (SW).	SW						6' - Water in borehole
	9'-20' Medium sand, trace silt, poorly graded, micaceous, tan, wet, (SP).	SP	—	2		3-2-1	12:55	Augers sink slightly
15			—	3		11-17-36	13 05	water added (2.5 gallons)
20			—	4		3-3-4	13:20	
	TD = 20.5'							
25								
30								

WELL CONSTRUCTION LOG

PROJECT NAME: Port Hueneme

PROJECT NUMBER: 89-652

WELL LOCATION: Site 14

LOGGED BY: M. Powell

DEPTH TO WATER (FEET FTOC): 7.5

DRILLING CO.: Layne Western

DRILLER: Mark Westhoff

RIG TYPE: CME 75

DRILLING METHOD: HSA

BOREHOLE DIAMETER (INCHES): 10

SAMPLING METHOD: Split Barrel

SAMPLING INTERVAL (FEET): 5

TOTAL DEPTH DRILLED (FEET): 20.5

CASING TYPE: Sch. 40 PVC

CASING DIAMETER (INCHES O.D.): 4

SCREEN TYPE: Sch. 40 PVC, slotted

SLOT SIZE (INCHES): 0.01

SCREENED INTERVAL (FEET): 3.5 TO 18.5

CASING INTERVAL (FEET): +1.5 TO 19.0

FILTER PACK: Lonestar #2/12

FILTER INTERVAL (FEET): 3.5 TO 19.0

BENTONITE SEAL (FORM): Volclay 1/4 tablets

BENTONITE INTERVAL (FEET): 2.0 TO 3.5

GROUT TYPE: Portland cement + sand

PERCENT BENTONITE IN GROUT: 0

GROUT INTERVAL (FEET): 0 TO 2.0

WELLHEAD: Locking steel monument

COMMENTS: 7.5 bags sand used;

one cal bentonite

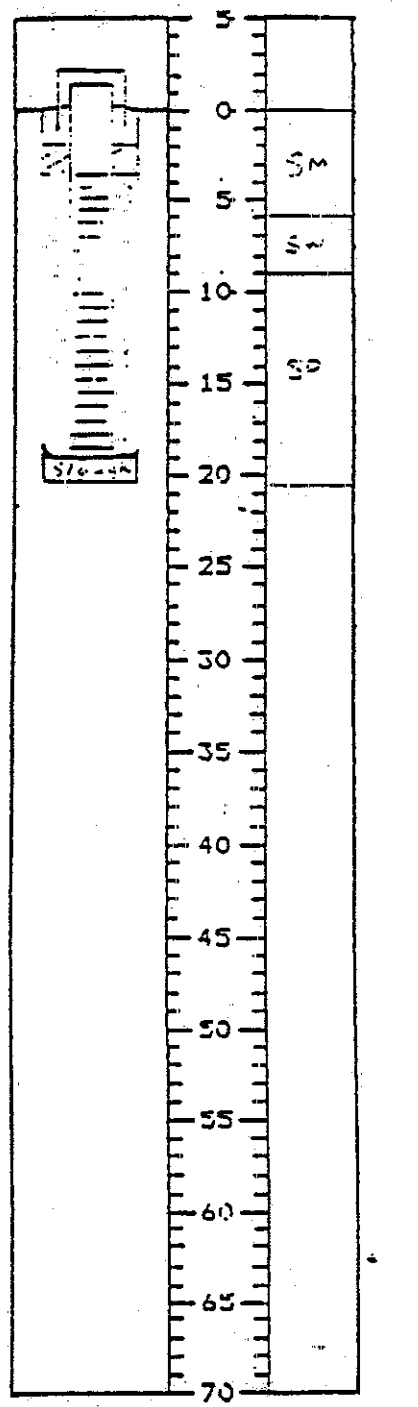
ESL of top of casing is 3.89'

WELL NUMBER: S14-W1

DRILLING PROGRESS

DATE	START	FINISH
11-18-89	12:30	13:30

WELL SKETCH
(DEPTH IN FEET)



WELL DEVELOPMENT LOG

PROJECT NAME: Port Hueneme
PROJECT NUMBER: 89-652

DATE: 12/12/89
LOGGED BY: J.T. / M.P.

WELL NO.: S14-W1
LOCATION:

DIAMETER: 4"

DEPTH TO BOTTOM 20.10
DEPTH TO WATER 7.55
SCREEN INTERVAL 3.5 TO 18.5

DEVELOPMENT TECHNIQUE OR EQUIPMENT USED: 100 lb. Surge block w/ PVC bailer

1. Surge Interval: 17.1 to 14.1 Time: 07.54 to 08.04
2. Surge Interval: 14.1 to 11.1 Time: 08.04 to 08.14
3. Surge Interval: 11.1 to 7.55 Time: 08.14 to 08.24
4. Surge Interval: 17.1 to 7.55 Time: 08.24 to 08.29
5. Surge Interval: _____ to _____ Time: _____ to _____
6. Surge Interval: _____ to _____ Time: _____ to _____
7. Surge Interval: _____ to _____ Time: _____ to _____
8. Surge Interval: _____ to _____ Time: _____ to _____
9. Surge Interval: _____ to _____ Time: _____ to _____
10. Surge Interval: _____ to _____ Time: _____ to _____

TIME	GALLONS BAILED	WATER CONDITION	pH	TEMP	CONDUCTIVITY
08.30	10	Very Muddy	4.2	22	4.41
08.45	35	Muddy	8.2	23	4.80
08.55	55	cloudy	8.05	23	4.65
09.03	85	Cloudy	8.06	23	4.56
09.23	180	slightly Cloudy	8.13	23	4.45
09.55	130	Transparent.	7.88	23	4.55
10.02	150	clear	8.13	23	4.74
10.07	165	Clear	—	—	—

REMARKS O V A. B.G = 0.3 ppm
Well head 0.3 ppm

The Earth Technology Corporation

BOREHOLE LOG

Project Name: Site Inspection Study, NCBC Port Hueneme			
Project Number: 89-652	Borehole Number: SI4-W2		Sheet 1 of 1
Borehole Location: Site 14		Elevation and Datum: —	
Drilling Company: Layne Western	Driller: Mark Westhoff	Date Started: 11/16/88	Date Finished: 11/16/88
Drilling Equipment: CME 75		Total Depth (feet): 20.5	Depth to Bedrock (feet): NA
Drilling Method: HSA		Borehole Diameter: 10"	
Drilling Fluid: none		Depth to Water (feet): First: 7	Compl.: 4.5 24 hrs.
Completion Information: Completed as monitoring well SI4-W2		Logged By: D. Baxley	Checked by: J. D. [illegible]

Depth (feet)	Description	Lithology	OVA (ppm)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Drilling Rate/Time	Remarks
								OVA Background: 2 ppm
0	0-5' Gravelly sand, sand fine to coarse grained, gravel to 3", well graded, angular/subround, brown (nearly black), moist, SW.	SW					1:56	Start
								3' - rig caution
								OVA: 2
5	2' - becoming brown		4.4	1		2-5-7	2:02	
	5'-7' Silty fine sand, poorly graded, subround, micaceous, many wood fragments, grey, wet, SM.	SM						Muddy cuttings - 7' - water in borehole
								OVA: 2 ; H 3.5
10	7'-19' Fine to medium sand, trace silt, poorly graded, subround, grey, wet, SP.	SP	4.4	2		10-5-16	2:12	Drillers having trouble with heaving sands, adding "city water" - 10' of water in 8" auger
	14' - subround gravel (1/2") in above sand		20	3		8-8-7	2:32	
15								
	19'-20.5' Sandy silt, sand fine, micaceous, grey, wet, ML.	ML	60	4		2-3-5	2:40 2:46	16 gallons water added
20								
	TD: 20.5'							
25								
30								

Corporation

WELL CONSTRUCTION LOG

PROJECT NAME: Port Hueneme

PROJECT NUMBER: 89-652

WELL LOCATION: Site 14

LOGGED BY: D. Baxley

DEPTH TO WATER (FEET FTOC): 4.

DRILLING CO.: Layne Western

DRILLER: Mark Westhoff

RIG TYPE: CME 75

DRILLING METHOD: HSA

BOREHOLE DIAMETER (INCHES): 10

SAMPLING METHOD: Split barrel

SAMPLING INTERVAL (FEET): 5

TOTAL DEPTH DRILLED (FEET): 20

CASING TYPE: Schd. 40 PVC

CASING DIAMETER (INCHES O.D.): 4

SCREEN TYPE: Schd 40 PVC, slotted

SLOT SIZE (INCHES): 0.01

SCREENED INTERVAL (FEET): 3.5 TO 18.5

CASING INTERVAL (FEET): 0.4 TO 19.0

FILTER PACK: Lonestar #2/12

FILTER INTERVAL (FEET): 2.5 TO 20.0

BENTONITE SEAL (FORM): Volclay 1/4" tablets

BENTONITE INTERVAL (FEET): 1.5 TO 2.5

GROUT TYPE: Portland cement

PERCENT BENTONITE IN GROUT: 0

GROUT INTERVAL (FEET): +0.2 TO 1.5

WELLHEAD: Locking traffic-rated well box

COMMENTS:

MSL of top of casing is 3.3'

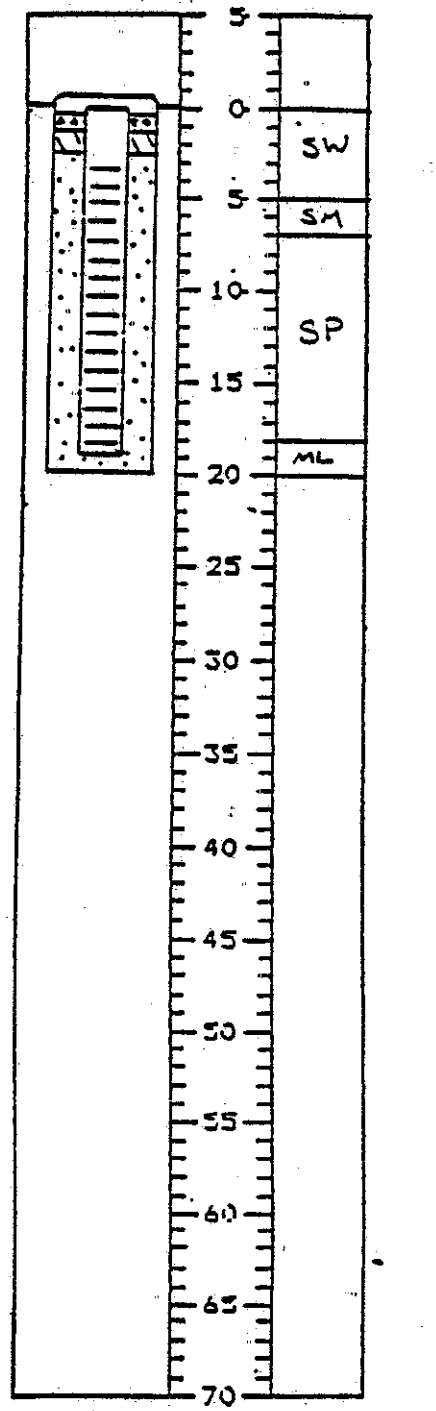
WELL NUMBER: S14-W2

DRILLING PROGRESS

DATE	START	FINISH
11-16-88	1156	2:46

WELL SKETCH
(DEPTH IN FEET)

CONSTRUCTION GEOLOGIC



WELL DEVELOPMENT LOG

PROJECT NAME: Port Hueneme
PROJECT NUMBER: 89-652
DATE: 12/3/88
LOGGED BY: J.T./M.B.

WELL NO.: S14-W2
DIAMETER: 4"
LOCATION:
DEPTH TO BOTTOM 14.5
DEPTH TO WATER 4.65
SCREEN INTERVAL 15.5 TO 4.65

DEVELOPMENT TECHNIQUE OR EQUIPMENT USED: 100 lb Surge block w/PVC Bailer

1.	Surge Interval: 15.5	to 12.5	Time: 10.49	to 10.59
2.	Surge Interval: 12.5	to 9.5	Time: 10:59	to 11.09
3.	Surge Interval: 9.5	to 4.65	Time: 11.09	to 11:19
4.	Surge Interval: 15.5	to 4.65	Time: 11.19	to 11:24
5.	Surge Interval:	to	Time:	to
6.	Surge Interval:	to	Time:	to
7.	Surge Interval:	to	Time:	to
8.	Surge Interval:	to	Time:	to
9.	Surge Interval:	to	Time:	to
10.	Surge Interval:	to	Time:	to

TIME	GALLONS BAILED	WATER CONDITION	pH	TEMP	CONDUCTIVITY	
11:26	10	Muddy	7.27	22	7.70	w/extende
11:31	35	Very Cloudy	7.26	22	5.40	"
11:40	55	Cloudy	7.44	22	4.70	"
11:50	85	Slightly Cloudy	7.31	22	5.74	"
11:57	110	Transparent	7.52	22	3.85	"

REMARKS B.G. OVA = 1.00ppm. @ Well 1.6 to 8.0 ppm
Breathing Zone 1.00 ppm
Ground water was very foamy

Corporation

BOREHOLE LOG

Project Name: Site Inspection Study, NCBC Port Hueneme			
Project Number: 89-652	Borehole Number: S14-W3		Sheet 1 of 1
Borehole Location: Site 14		Elevation and Datum: —	
Drilling Company: Layne Western	Driller: M. Westhoff	Date Started: 11-17-88	Date Finished: 11-17-88
Drilling Equipment: CME 75		Total Depth (feet): 25.0	Depth to Bedrock (feet): —
Drilling Method: HSA		Borehole Diameter: 10"	
Drilling Fluid: none		Depth to Water (feet): First: 11	Comp.: 6.7 24 hrs —
Completion Information: Completed as monitoring well S14-W3		Logged By: D. Baxley	Checked by: V. Dukes

Depth (feet)	Description	Lithology	OVA (ppm)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Drilling Rate/Time	Remarks
								OVA Background: 2 ppm
	0-5' Silty sand, trace gravel, sand fine to coarse grained, well graded, subround, brown, slightly moist, (SM).	SM					7:40	Start
								OVA: 2 ; Hole: 2
5			3.5	1	SS	3-3-10	7:44	Hard drilling, cobbles?
	5'-7' Clayey fine sand, little silt, brown, moist, slightly plastic, (SC).	SC						
	7'-12' Silty clay, trace fine sand, highly micaceous, organic (?), grey with black patches, , plastic, (CH).	CH	30	2	SS	2-3-4	7:52	11'- Water in borehole
10								
	12'-25' Fine to medium sand, little silt, poorly graded, subround, micaceous, grey, wet, (SP).	SP	15	3	SS	16-20-34	8:02	OVA: 2 ; Hole: 6
15								
	17'- becoming medium sand.							No cuttings produced
20			22	4	SS	3-8-7	8:17	Heaving problems
25							8:40	Drilled to 25' to create sump.
	TD: 25.0'							
30								

WELL CONSTRUCTION LOG

PROJECT NAME: Port Hueneme

PROJECT NUMBER: 89-652

WELL LOCATION: Site 14

LOGGED BY: D. Baxley

DEPTH TO WATER (FEET FTOC): 6.7

DRILLING CO.: Layne Western

DRILLER: Mark Westhaff

RIG TYPE: CME 75

DRILLING METHOD: HSA

BOREHOLE DIAMETER (INCHES): 10

SAMPLING METHOD: Split barrel

SAMPLING INTERVAL (FEET): 5

TOTAL DEPTH DRILLED (FEET): 25

CASING TYPE: Sch. 40 PVC

CASING DIAMETER (INCHES O.D.): 4

SCREEN TYPE: Sch 40 PVC, slotted

SLOT SIZE (INCHES): 0.01

SCREENED INTERVAL (FEET): 4.1 TO 19.1

CASING INTERVAL (FEET): +0.9 TO 19.6

FILTER PACK: Lonestar #2/12

FILTER INTERVAL (FEET): 3.0 TO 25.0

BENTONITE SEAL (FORM): Volclay 1/4 tablets

BENTONITE INTERVAL (FEET): 1.5 TO 3.0

GROUT TYPE: Portland cement + sand

PERCENT BENTONITE IN GROUT: 0

GROUT INTERVAL (FEET): +0.2 TO 1.5

WELLHEAD: Locking monument

COMMENTS: 8 bags sand used,

1 x 1 bentonite

USL of top of casing = 3.46'

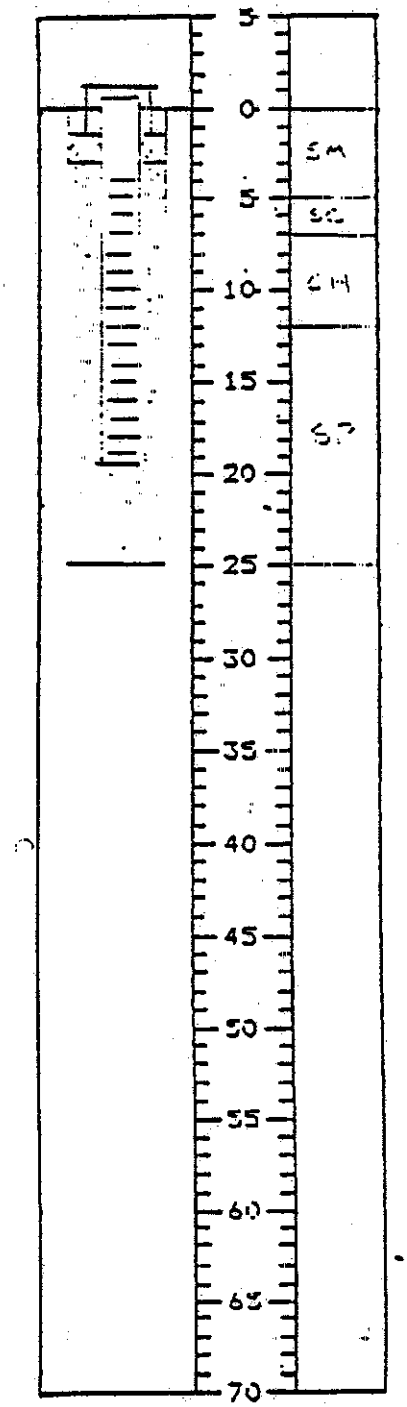
WELL NUMBER: S14-W3

DRILLING PROGRESS

DATE	START	FINISH
11-7-89	7:40	12:40

. WELL SKETCH
(DEPTH IN FEET)

CONSTRUCTION GEOLOGIC



WELL DEVELOPMENT LOG

PROJECT NAME: Port Hueneme
PROJECT NUMBER: 89-652
DATE: 12/2/88
LOGGED BY: J. Lamb

WELL NO.: S14-W3
DIAMETER: 4"
LOCATION:
DEPTH TO BOTTOM 20.0
DEPTH TO WATER 6.75
SCREEN INTERVAL 4.1 TO 14.1

DEVELOPMENT TECHNIQUE OR EQUIPMENT USED: 10014 Surge block w/ PVC Bailer

1.	Surge Interval:	17.0	to 14.0	Time:	13 15	to 13 25
2.	Surge Interval:	14.0	to 11.0	Time:	13 25	to 13 35
3.	Surge Interval:	11.0	to 6.70	Time:	13 35	to 13 45
4.	Surge Interval:	6.70	to 17.0	Time:	13 45	to 13 50
5.	Surge Interval:		to	Time:		to
6.	Surge Interval:		to	Time:		to
7.	Surge Interval:		to	Time:		to
8.	Surge Interval:		to	Time:		to
9.	Surge Interval:		to	Time:		to
10.	Surge Interval:		to	Time:		to

TIME	GALLONS BAILED	WATER CONDITION	pH	TEMP	CONDUCTIVITY
1400	10	Muddy	6.03	24.0	18.49
14.07	30	Muddy	7.90	24.0	18.33
14.15	40	Very Cloudy	7.98	24.0	19.51
14.20	65	Cloudy	7.83	24.0	19.18
14.25	80	Slightly Cloudy	7.87	24.0	19.23
14.35	110	Transparent	7.84	24.0	18.74

REMARKS OVA B.G. = 0.8 Wellhead = 0.8
Water had Slight Smell B.G. = 0.0 bucket = 0.4

The Earth Technology Corporation

BOREHOLE LOG

Project Name: Site Inspection Study, NCBC Port Hueneme			
Project Number: 89-652	Borehole Number: S14-W4		Sheet 1 of 1
Borehole Location: Site 14		Elevation and Datum:	
Drilling Company: Layne Western	Driller: M. Westhoff	Date Started: 11-17-88	Date Finished: 11-17-88
Drilling Equipment: CME 75		Total Depth (feet): 25.0	Depth to Bedrock (feet): —
Drilling Method: HSA		Borehole Diameter: 10"	
Drilling Fluid: none		Depth to Water (feet): First: 6	Compl.: 7.3 24 hrs. —
Completion Information: Completed as monitoring well S14-W4		Logged By: D. Baxley	Checked by: J. Dahm

Depth (feet)	Description	Lithology	OVA (ppm)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Drilling Rate/Time	Remarks
								OVA Background: 1 ppm
0	0-3' Silty sand, trace gravel, sand fine to coarse grained, gravel to 3", well graded, angular / subround, micaceous, many roots, brown, moist, (SM).	SM					1:55	Start
5	2'- less roots	SP	4	1	/	8-7-6	1:58	OVA: 1 ; Hole: 1
	3'-8' Fine sand, trace silt, poorly graded, subround, highly micaceous, grey, very moist, (SP).							Cuttings wet
10	6'- becoming wet.	CH	7	2	/	1-2-3	2:06	10' sample very black, contains black "goo"
	8'-13' Silty clay, highly micaceous, fossiliferous (?), grey with black patches, wet, plastic, (CH).							• water added (75 gal)
15			5	3	/	6-10-20	2:13	Sampler stuck
	13'-24' Medium sand, poorly graded, subround, slightly micaceous, grey, wet, (SP)	SP						OVA: 1 ; Hole: 1
20			40	4	/	4-9-12	2:27	Water added (310 gal)
								Easy Drilling
25	24'-25' Silty clay(?)	CH					2:40	
	TD: 25.0'							
30								

WELL CONSTRUCTION LOG

PROJECT NAME: Port Wentworth

PROJECT NUMBER: 29-652

WELL LOCATION: Site 14

LOGGED BY: D. Bixby

DEPTH TO WATER (FEET FTOC): 7.3

DRILLING CO.: Layne Western

DRILLER: Mark Westhoff

RIG TYPE: CME 75

DRILLING METHOD: HSA

BOREHOLE DIAMETER (INCHES): 10

SAMPLING METHOD: Split barrel

SAMPLING INTERVAL (FEET): 5

TOTAL DEPTH DRILLED (FEET): 25

CASING TYPE: Sch. 40 PVC

CASING DIAMETER (INCHES O.D.): 4

SCREEN TYPE: Sch. 40 PVC, slotted

SLOT SIZE (INCHES): 0.01

SCREENED INTERVAL (FEET): 4.1 TO 19.1

CASING INTERVAL (FEET): +0.9 TO 19.6

FILTER PACK: Lonestar #2/12

FILTER INTERVAL (FEET): 2.9 TO 25

BENTONITE SEAL (FORM): Quikrete 1/4 chips

BENTONITE INTERVAL (FEET): 1.3 TO 2.9

GROUT TYPE: Portland cement + sand

PERCENT BENTONITE IN GROUT: 0

GROUT INTERVAL (FEET): 0 TO 1.3

WELLHEAD: Locking steel monument

COMMENTS: 10.5 bags sand, 1 pail bentonite

Ht. of top of casing is 3.75'

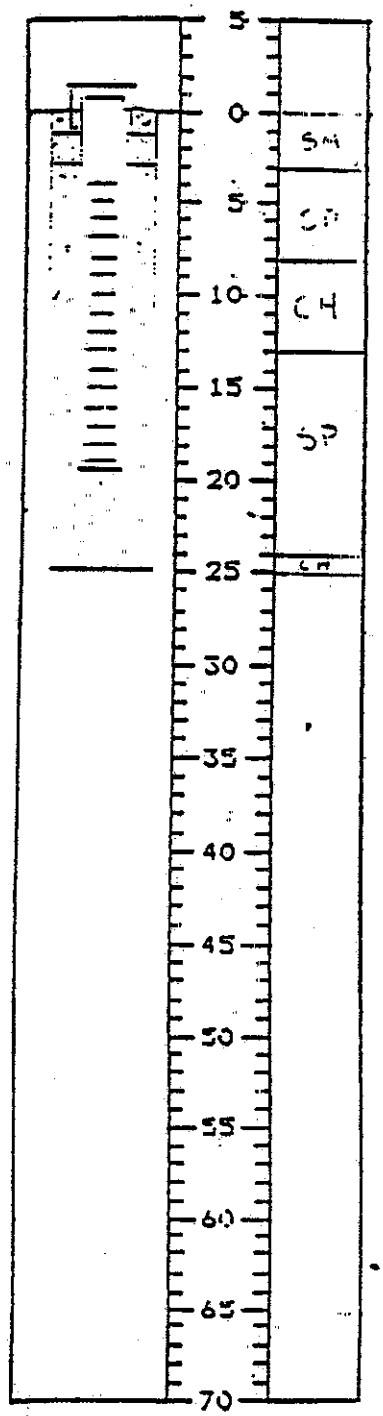
WELL NUMBER: S/4-W4

DRILLING PROGRESS

DATE	START	FINISH
11/29/82	1:55	2:40

. WELL SKETCH
(DEPTH IN FEET)

CONSTRUCTION GEOLOGIC



WELL DEVELOPMENT LOG

PROJECT NAME: Port Hueneme
PROJECT NUMBER: 89-652
DATE: 12-2-88
LOGGED BY: J.T / M.P.

WELL NO.: S14-W4
LOCATION: S.E. 14
DIAMETER: 4"
DEPTH TO BOTTOM 20.1
DEPTH TO WATER 7.35
SCREEN INTERVAL 19.4 TO 44

DEVELOPMENT TECHNIQUE OR EQUIPMENT USED: 100 lb Surge block w/ PVC Bailer

1.	Surge Interval: 17.1	to 14.1	Time: 15:13	to 15:23
2.	Surge Interval: 14.1	to 11.1	Time: 15:23	to 15:33
3.	Surge Interval: 11.1	to 7.35	Time: 15:33	to 15:43
4.	Surge Interval: 17.1	to 7.35	Time: 15:43	to 15:48
5.	Surge Interval:	to	Time;	to
6.	Surge Interval:	to	Time:	to
7.	Surge Interval:	to	Time:	to
8.	Surge Interval:	to	Time:	to
9.	Surge Interval:	to	Time:	to
10.	Surge Interval:	to	Time:	to

TIME	GALLONS BAILED	WATER CONDITION	pH	TEMP	CONDUCTIVITY
15:52	10	Muddy	8.16	24	1 on all scales
16:06	35	Muddy + foamy	8.10	24	"
16:16	55	Muddy - foamy	8.02	24	"
16:23	70	Very Cloudy	7.81	24	7.28 on 20ms/ with extra
16:46	90	Cloudy	7.54	24	5.21 " / "
17:02	108	Slightly Cloudy	7.60	24	5.70 " / "

REMARKS OVA 06 = 0.05 - 20.3ppm @ well head - 0 in breathing Zone
16:03 OVA: 70-80ppm @ Borehole, 7ppm bucket, 0 breathing Zone
16:12 = 70ppm " , " , 0.7 " "
16:23 = 40ppm " , 30ppm " , 0.3 " "
16:50 — , — , 0.3 " "
17:00 — , — , 1.0 " "

APPENDIX D-2

LIST OF ANALYTES

APPENDIX D-2

LIST OF ANALYTES FOR DETECTION MONITORING
(from Appendix I of 40 CFR 258.54)

Analyte	Recommended Reporting Limit (µg/L)
Inorganic Compounds Analyte List and Reporting Limits	
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Chromium	10
Cobalt	50
Copper	25
Lead	3
Nickel	40
Selenium	5
Silver	10
Thallium	10
Vanadium	50
Zinc	20
Organic Compounds Analyte List and Reporting Limits	
Acetone	10
Acrylonitrile	10
Benzene	10
Bromochloromethane	10
Bromodichloromethane	10
Bromoform	10
Carbon disulfide	10
Carbon tetrachloride	10
Chlorobenzene	10
Chloroethane	10
Chloroform	10
Dibromochloromethane	10
1,2-Dibromo-3-chloropropane	10
1,2-Dibromoethane	10
o-Dichlorobenzene	10
p-Dichlorobenzene	10
trans-1,4-Dichloro-2-butene	10
1,1-Dichloroethane	10
1,2-Dichloroethane	10
1,1-Dichloroethylene	10
cis-1,2-Dichloroethylene	10

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR DETECTION MONITORING
(from Appendix I of 40 CFR 258.54)

Analyte	Recommended Reporting Limit (µg/L)
trans-1,2-Dichloroethylene	10
1,2-Dichloropropane	10
cis-1,3-Dichloropropene	10
trans-1,3-Dichloropropene	10
Ethylbenzene	10
2-Hexanone	10
Methyl bromide	10
Methyl chloride	10
Methylene bromide	10
Methylene chloride	10
Methyl ethyl ketone	10
Methyl iodide	10
4-Methyl-2-pentanone	10
Styrene	10
1,1,1,2-Tetrachloroethane	10
1,1,2,2-Tetrachloroethane	10
Tetrachloroethylene	10
Toluene	10
1,1,1-Trichloroethane	10
1,1,2-Trichloroethane	10
Trichloroethylene	10
Trichlorofluoromethane	10
1,2,3-Trichloropropane	10
Vinyl acetate	2
Vinyl chloride	10
Xylenes	10

Notes:

µg/L Micrograms per liter

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR ASSESSMENT MONITORING
(from Appendix II of 40 CFR 258.55)

Analyte	Recommended Reporting Limit (µg/L)
Semivolatile Organic Compounds Analyte List and Reporting Limits	
Benzaldehyde	10
Phenol	10
bis(22-chloroethyl)ether	10
2-Chlorophenol	10
2-Methylphenol	10
2,2'-oxybis(1-chloropropane)	10
Acetophenone	10
4-methylphenol	10
N-nitroso-di-n-propylamine	10
Hexachloroethane	10
Nitrobenzene	10
Isophorone	10
2-Nitrophenol	10
2,4-Dimethylphenol	10
bis(2-Chloroethoxy)methane	10
2,4-Dichlorophenol	10
Naphthalene	10
4-Chloroaniline	10
Hexachlorobutadiene	10
Caprolactum	10
4-Chloro-32-methylphenol	10
2-Methylnaphthalene	10
Hexachlorocyclopentadiene	10
2,4,6-Trichlorophenol	10
2,4,5-Trichlorophenol	25
1,1'-Biphenol	10
2-Chloronaphthalene	10
2-Nitroaniline	25
Dimethylphthalate	10
2,6-Dinitrotoluene	10
Acenaphthylene	10
3-Nitroaniline	25
Acenaphthene	10
2,4-Dinitrophenol	25
4-Nitrophenol	25
Dibenzofuran	10

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR ASSESSMENT MONITORING
(from Appendix II of 40 CFR 258.55)

Analyte	Recommended Reporting Limit (µg/L)
Semivolatile Organic Compounds Analyte List and Reporting Limits (Continued)	
2,4-Dintrotoluene	10
Diethylphthalate	10
Fluorene	10
4-Chlorophenyl-phenyl ether	10
4-Nitroaniline	25
4,6-Dimtro-2-methylphenol	25
N-nitrosodiphenylamine	10
4-Bromophenylphenylether	10
Hexachlorobenzene	10
Atrazine	10
Pentachlorophenol	25
Phenathrene	10
Antracene	10
Carbozole	10
Di-n-butylphthalate	10
Fluoranthene	10
Pyrene	10
Butylbenzylphthalate	10
3,3'-Dichlorobenzidine	10
Benzo(a)anthtacen	10
Chrysene	10
Bis(2-ethylhexyl)phthalate	10
Di-n-octylphthalate	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(a)pyrene	10
Indeno(1,2,3-cd)pyrene	10
Dibenzo(a,h)anthracene	10
Benzo(g,h,i)perylene	10
Volatile Organic Compounds Analyte List and Reporting Limits	
Dichlorodifluoromethane	10
Chloromethane	10
Vinyl Chloride	10
Bromomethane	10
Chloroethane	10
Trichlorofluoromethane	10
1,1-Dichloroethene	10
1,1,2-Trichloro 1,2,2-trichloroethane	10

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR ASSESSMENT MONITORING
(from Appendix II of 40 CFR 258.55)

Analyte	Recommended Reporting Limit (µg/L)
Volatile Organic Compounds Analyte List and Reporting Limits (Continued)	
Acetone	10
Carbon Dissulfide	10
Methyl Acetate	10
Methylene Chloride	10
trans-1,2-Dichloroethene	10
tert-Butyl Methyl Ether	10
1,1-Dichloroethane	10
cis-1,2-Dichloroethene	10
2-Butanone	10
Chloroform	10
1,1,1-Trichloroehtane	10
Cyclohexane	10
Carbon Tetrachloride	10
Benzene	10
1,2-Dichloroethane	10
Trichloroethene	10
Methylcyclohexane	10
1,2-Dichloropropane	10
Bromodichloromethane	10
cis-1,3-Dichloropropene	10
4-Methyl-2-pentanone	10
Toluene	10
trans-1,3-Dichloropropene	10
1,1,2-Trichloroethene	10
Tetrachloroethene	10
2-Hexanone	10
Dibromochloromethane	10
1,2-dibromoethane	10
Chlorobenzene	10
Ethylbenzene	10
Xylenes (total)	10
Styrene	10
Bromoform	10
Isopropylbenzene	10
1,1,2,2-Tetrachloroethane	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
1,2-Dichlorbenzene	10
1,2-Dibromo-3-chloropropane	10
1,2,4-Trichlorobenzene	10

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR ASSESSMENT MONITORING
(from Appendix II of 40 CFR 258.55)

Analyte	Recommended Reporting Limit (µg/L)
Pesticide and Polychlorinated Biphenyl Analyte List and Reporting Limits	
alpha-BHC	0.050
beta-BHC	0.050
delta BHC	0.050
gamma-BHC (Lindane)	0.050
Hepatchlor	0.050
Aldrin	0.050
Heptachlor epoxide	0.050
Endosulfan I	0.050
Dieldrin	0.10
4,4'-DDE	0.10
Endrin	0.10
Endosulfan II	0.10
4,4'-DDD	0.10
Endosulfan sulfate	0.10
4,4'-DDT	0.10
Methoxychlor	0.50
Endrin ketone	0.10
Endrin aldehyde	0.10
alpha-Chlordane	0.050
gamma-Chlordane	0.050
Toxaphene	5.0
Aroclor-1016	1.0
Aroclor-1221	2.0
Aroclor-1232	1.0
Aroclor-1242	1.0
Aroclor-1248	1.0
Aroclor-1254	1.0
Aroclor-1260	1.0
Dissolved Metals Analyte List and Reporting Limits	
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR ASSESSMENT MONITORING
(from Appendix II of 40 CFR 258.55)

Analyte	Recommended Reporting Limit (µg/L)
Dissolved Metals Analyte List and Reporting Limits (Continued)	
Hexavalent Chromium	10
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Organo Phosphorus Analyte List and Reporting Limits	
Azinphos-methyl	1.0
Bolstar (Sulprofos)	0.70
Chloropyrifos	0.70
Coumaphos	2.0
O, S-Demeton	1.2
Diazinon	2.0
Dichlorvos (DDVP)	8.0
Dimethoate	2.6
Disulfoton	0.7
EPN	0.4
Ethoprop	2.0
Fensulfothion	0.8
Fention	0.8
Malathion	1.1
Mevinphos	5.0
Merphos	2.0
Naleds	5.0
Ethyl parathion	0.6
Methyl parathion	1.2
Phorate	0.4
Ronnel	0.7
Sulfotepp	0.7
TEPP	8.0
Tetrachloviphos	8.0
Tokthion (Protothiofos)	0.7
Trichloronate	8.0

APPENDIX D-2 (Continued)

LIST OF ANALYTES FOR ASSESSMENT MONITORING
(from Appendix II of 40 CFR 258.55)

Analyte	Recommended Reporting Limit (µg/L)
Chlorinated Herbicides Analyte List and Reporting Limits	
2,4-D	0.2
2,4-DB	0.8
2,4,5-TP (Silvex)	0.075
Dalapon	1.3
Dicamba	0.081
Dichloroprop	0.26
Dinoseb	0.19
MCPA	0.056
MCPP	0.09
4-Nitrophenol	0.13
Pentachlorophenol	0.076

Notes:

2,4-D Dichlorophenoxy acetic acid
2,4-DB Dichlorophenoxy butyric acid
µg/L Micrograms per liter
BHC Benzene hexachloride
DDD Dichlorodiphenyl dichloroethane
DDE Dichlorodiphenyl dichloroethylene
DDT Dichlorodiphenyl trichloroethane
EPN Ethyl O-(p-nitrophenyl)phenylphosphonotionate
MCPA (4-chloro-2-methylphenoxy) acetic acid
MCPP (4-chloro-2-methylphenoxy) propionic acid
TEPP Tetraethylpyrophosphate

APPENDIX D-3

CHAIN OF CUSTODY FORM

Tetra Tech EM Inc.
1099 18th Street Ste. 1960
Denver, CO 80202
(303) 295-1101

CHAIN OF CUSTODY RECORD NUMBER

DATE: _____ Page _____ of _____

TtEMI Number (opt) _____

DESTINATION: _____

Project Name	Project Job Number	Preservation	Analyses Required	
Sampler(s) Printed Name and Signature	Technical Contact	No./Container Types		M S

Sample I.D.	Date of collection	Time	Matrix																				

SIGNATURE	NAME (Print)	Company	Date	Time
RELINQUISHED BY:				
RECIEVED BY:				
RELINQUISHED BY:				
RECIEVED BY:				
RELINQUISHED BY:				
RECIEVED BY:				

REMARKS:

Airbill #

Turnaound Time

INSTRUCTIONS: Under "ANALYSIS REQUIRED" enter only one of the following four codes for each analysis requested and each sample listed:

U=UNPRESEVERED AND UNFILTERED SAMPLE **P=PRESERVED SAMPLE** **F=FILTERED SAMPLE** **B=BOTH PRESERVED & FILTERED SAMPLE**

White Copy to Laboratory

Yellow Copy to Project Chemist

Pink copy to Project Manager

APPENDIX E

POSTCLOSURE MAINTENANCE COST OPINION

LOCATION: Naval Construction Battalion Center City of Port Hueneme County of Ventura State of California	**SPEC NO:**									
	ORIGINATOR OF OPINION: SWF **FIRM:** Tetra Tech EM Inc.				**CHECKED BY:** RGH **FIRM:** Tetra Tech EM Inc.				**DATE:** 11-Jun-01	
PROJECT TITLE: Installation Restoration Program Site 14 Landfill Final Cover Phase 3 - Postclosure Maintenance	**SUBMITTAL STATUS:** F I N A L				**SWDIV DELIVERY ORDER NO:** N62474-94-D-7609 CTO 0206					
	Quantity Amount	Quantity Unit	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Opinion Total Unit Cost	Opinion Total Cost

SUMMARY:

This cost opinion includes costs for postclosure maintenance of the landfill final cover at IRP Site 14 according to the Final Postclosure Maintenance Plan.
Year-specific annual outlay for postclosure maintenance included.
Differences due to rounding exist.

ASSUMPTIONS:

1) Project duration is 30 years
2) Laborer rates are based on Davis-Bacon Wage Rates for Ventura County, California but do not include fringes.
3) All field work can be accomplished in modified level D (normal work clothes)
4) Subcontracted work is subject to +10% cost adjustment and includes fringes.
5) Local costs correction factors applied to material and equipment in Oxnard, CA per [M]
6) Ground surveying for settlement markers scheduled for first 3 years only. Additional years may be necessary.
7) Frequency of sampling and analysis of groundwater based on unfavorable results. Favorable results require reduced frequency.
8) Postclosure cost increased by a factor of 20% to account for cost over-runs due to unforeseen circumstances.
9) Project Management includes requisite meetings with Navy and for Quality Control and reports preparation.

NOTES:

1) Supporting calculations, reference sources, and additional assumptions are included in attachments
2) Costs are shown in U.S. dollars
3) Items preceded by an "s" are considered subcontractor activities.

SOURCES:

1) [M] 2000 Site Work and Landscape Cost Data, 14th ed., R.S. Means Company, Inc., Kingston, MA, 1999
2) [DB] Davis Bacon and Related Acts, 29 CFR Parts 1, 3, and 5.
3) Local vendor and contractor / subcontractor quotes
4) Hazardous, Toxic, and Radioactive Waste Remedial Action Work Breakdown Structure (WBS), Naval Energy and Environmental Support Activity [NEESA] 1993.

LOCATION:	SPEC NO:									
Naval Construction Battalion Center Naval Base Ventura County Port Hueneme Site City of Port Hueneme County of Ventura State of California	ORIGINATOR OF OPINION: SWF FIRM: Tetra Tech EM Inc.				CHECKED BY: RGH FIRM: Tetra Tech EM Inc.				DATE: 11-Jun-01	
PROJECT TITLE: Installation Restoration Program Site 14 Landfill Final Cover Phase 3 - Postclosure Maintenance	SUBMITTAL STATUS: F I N A L				SWDIV DELIVERY ORDER NO: N62474-94-D-7609 CTO 0206					

			Quantity Amount	Quantity Unit	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Opinion Total Unit Cost	Opinion Total Cost
Total (no inflation, no present worth)						**$365,836**		**$76,985**		**$688,643**		**$1,131,465**
Contingency @ 20%						$60,973		$12,831		$114,774		$188,577
33 Hazardous, Toxic, and Radioactive Waste						**$304,864**		**$64,154**		**$573,870**		**$942,887**
33.01 Mobilization and Preparatory Work						**$38,712**		**$0**		**$0**		**$38,712**
33.01.03 Preconstruction Submittals / Implementation Plans						**$38,712**		**$0**		**$0**		**$38,712**
	33.01.03.04	*Environmental Protection Plan*	6	ea	$2,474	$14,844		$0		$0		$14,844
	33.01.03.08	*Site Safety & Health Plan*	6	ea	$1,504	$9,024		$0		$0		$9,024
	33.01.03.14	*Quality Control Plan*	6	ea	$2,474	$14,844		$0		$0		$14,844
33.02 Monitoring, Sampling, Testing and Analysis						**$76,929**		**$44,240**		**$561,864**		**$683,033**
33.02.03 Air Monitoring and Sampling						**$259**		**$840**				**$1,099**
	33.02.03.01	*Air Sampling - Real Time*	7	ea	$37	$259	$120	$840				$1,099
33.02.05 Sampling Groundwater						**$66,960**		**$43,400**		**$6,200**		**$116,560**
	33.02.05.02	*Groundwater Sampling*	62	ea	$1,080	$66,960	$700	$43,400	$100	$6,200		$116,560
33.02.09 Laboratory Chemical Analysis												
s	33.02.09.02	*Groundwater Analysis*	62	ea					$8,962	$555,664		$555,664
33.02.11 Geotechnical Testing						**$9,710**		**$0**		**$0**		**$9,710**
s	33.02.11.90	*Soil Moisture Testing*	30	ea	$324	$9,710		$0		$0		$9,710
33.20 Site Restoration						**$38,023**		**$19,914**		**$0**		**$57,937**
33.20.06 Post-Construction Maintenance						**$38,023**		**$0**		**$0**		**$57,937**
	33.20.06.90	*Inspections - Once per Month*										
		Inspect signs and gates	240	hr	$28	$6,641						$6,641
	33.20.06.91	*Inspections - Once per Quarter*										
		Inspect signs and gates	60	hr	$28	$1,660						$1,660
		Visual cover walk	60	hr	$28	$1,660						$1,660
		Final grading walk	60	hr	$28	$1,660						$1,660
		Gas Vents	60	hr	$28	$1,660						$1,660
		Wildlife search	60	hr	$37	$2,220						$2,220
	33.20.06.92	*Inspections - Once per 6 Months*										
		Inspect signs and gates	60	hr	$28	$1,660						$1,660
		Visual cover walk	60	hr	$28	$1,660						$1,660
		Final grading walk	60	hr	$28	$1,660						$1,660
		Wildlife search	60	hr	$37	$2,220						$2,220
		Gas Vents	60	hr	$28	$1,660						$1,660
		Drainage erosion check	60	hr	$28	$1,660						$1,660
	33.20.06.93	*Ground Survey*	3	aa	$0	$0	$221	$664		$0		$664
s	33.20.06.94	*Aerial Survey*	7	aa	$0	$0	$2,750	$19,250		$0		$19,250
	33.20.06.95	*Periodic Leak Search*	6	ea	$2,000	$12,000						$12,000
33.99 Distributive Costs						**$151,200**		**$0**		**$12,006**		**$163,206**
33.99.19 Home Office Costs						**$151,200**		**$0**		**$12,006**		**$163,206**
	33.99.19.90	*Program Management Office Support*	1	ls	$151,200	$151,200		$0	$12,006	$12,006		$163,206

ANNUAL OUTLAY
AND
PRESENT VALUE

3% Inflation Rate
6% Discount Rate
20% Contingency Applied

OPCC Section	YEAR >>>>	1	2	3	4	5	6	7	8	9	10	11	12
33.01.03.04	raw	$2,474	$0	$0	$0	$2,474	$0	$0	$0	$0	$2,474	$0	$0
	inflated	$3,058	$0	$0	$0	$3,442	$0	$0	$0	$0	$3,990	$0	$0
33.01.03.08	raw	$1,504	$0	$0	$0	$1,504	$0	$0	$0	$0	$1,504	$0	$0
	inflated	$1,859	$0	$0	$0	$2,092	$0	$0	$0	$0	$2,426	$0	$0
33.01.03.14	raw	$2,474	$0	$0	$0	$2,474	$0	$0	$0	$0	$2,474	$0	$0
	inflated	$3,058	$0	$0	$0	$3,442	$0	$0	$0	$0	$3,990	$0	$0
33.02.03.01	raw	$157	$0	$0	$0	$157	$0	$0	$0	$0	$157	$0	$0
	inflated	$194	$0	$0	$0	$218	$0	$0	$0	$0	$253	$0	$0
33.02.05.02	raw	$3,520	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760
	inflated	$9,295	$4,787	$4,930	$5,078	$5,231	$5,388	$5,549	$5,716	$5,887	$6,064	$6,246	$6,433
33.02.09.02	raw	$47,032	$15,791	$15,791	$15,791	$24,240	$15,791	$15,791	$15,791	$15,791	$24,240	$15,791	$15,791
	inflated	$58,132	$20,103	$20,706	$21,327	$33,721	$22,626	$23,305	$24,004	$24,724	$39,092	$26,230	$27,017
33.02.11.90	raw	$324	$324	$324	$324	$324	$324	$324	$324	$324	$324	$324	$324
	inflated	$400	$412	$424	$437	$450	$464	$478	$492	$507	$522	$538	$554
33.20.06.90	raw	$221	$221	$221	$221	$221	$221	$221	$221	$221	$221	$221	$221
	inflated	$274	$282	$290	$299	$308	$317	$327	$336	$347	$357	$368	$379
33.20.06.91	raw	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295
	inflated	$365	$376	$387	$399	$411	$423	$436	$449	$462	$476	$491	$505
33.20.06.92	raw	$351	$351	$351	$351	$351	$351	$351	$351	$351	$351	$351	$351
	inflated	$433	$446	$460	$474	$488	$503	$518	$533	$549	$566	$583	$600
33.20.06.93	raw	$221	$221	$221	$0	$0	$0	$0	$0	$0	$0	$0	$0
	inflated	$274	$282	$290	$0	$0	$0	$0	$0	$0	$0	$0	$0
33.20.06.94	raw	$2,750	$0	$0	$0	$2,750	$0	$0	$0	$0	$2,750	$0	$0
	inflated	$3,399	$0	$0	$0	$3,826	$0	$0	$0	$0	$4,435	$0	$0
33.20.06.95	raw	$0	$0	$0	$0	$2,000	$0	$0	$0	$0	$2,000	$0	$0
	inflated	$0	$0	$0	$0	$2,782	$0	$0	$0	$0	$3,225	$0	$0
33.99.19.90	raw	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440
	inflated	$6,724	$6,926	$7,134	$7,348	$7,568	$7,795	$8,029	$8,270	$8,518	$8,773	$9,037	$9,308
Total	raw	**$70,764**	**$26,404**	**$26,404**	**$26,182**	**$45,990**	**$26,182**	**$26,182**	**$26,182**	**$26,182**	**$45,990**	**$26,182**	**$26,182**
	inflated	**$87,464**	**$33,614**	**$34,622**	**$35,362**	**$63,979**	**$37,515**	**$38,641**	**$39,800**	**$40,994**	**$74,169**	**$43,491**	**$44,795**

ANNUAL OUTLAY
AND
PRESENT VALUE

3% Inflation Rate
6% Discount Rate
20% Contingency Applied

OPCC Section	YEAR >>>>	13	14	15	16	17	18	19	20	21	22	23	24
33.01.03.04	raw	$0	$0	$2,474	$0	$0	$0	$0	$2,474	$0	$0	$0	$0
	inflated	$0	$0	$4,625	$0	$0	$0	$0	$5,362	$0	$0	$0	$0
33.01.03.08	raw	$0	$0	$1,504	$0	$0	$0	$0	$1,504	$0	$0	$0	$0
	inflated	$0	$0	$2,812	$0	$0	$0	$0	$3,260	$0	$0	$0	$0
33.01.03.14	raw	$0	$0	$2,474	$0	$0	$0	$0	$2,474	$0	$0	$0	$0
	inflated	$0	$0	$4,625	$0	$0	$0	$0	$5,362	$0	$0	$0	$0
33.02.03.01	raw	$0	$0	$157	$0	$0	$0	$0	$157	$0	$0	$0	$0
	inflated	$0	$0	$294	$0	$0	$0	$0	$340	$0	$0	$0	$0
33.02.05.02	raw	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760
	inflated	$6,626	$6,825	$7,030	$7,240	$7,458	$7,681	$7,912	$8,149	$8,394	$8,645	$8,905	$9,172
33.02.09.02	raw	$15,791	$15,791	$24,240	$15,791	$15,791	$15,791	$15,791	$24,240	$15,791	$15,791	$15,791	$15,791
	inflated	$27,827	$28,662	$45,318	$30,408	$31,320	$32,259	$33,227	$52,537	$35,251	$36,308	$37,398	$38,520
33.02.11.90	raw	$324	$324	$324	$324	$324	$324	$324	$324	$324	$324	$324	$324
	inflated	$570	$587	$605	$623	$642	$661	$681	$702	$723	$744	$767	$790
33.20.06.90	raw	$221	$221	$221	$221	$221	$221	$221	$221	$221	$221	$221	$221
	inflated	$390	$402	$414	$426	$439	$452	$466	$480	$494	$509	$524	$540
33.20.06.91	raw	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295
	inflated	$520	$536	$552	$569	$586	$603	$621	$640	$659	$679	$700	$720
33.20.06.92	raw	$351	$351	$351	$351	$351	$351	$351	$351	$351	$351	$351	$351
	inflated	$618	$637	$656	$675	$696	$716	$738	$760	$783	$806	$831	$855
33.20.06.93	raw	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	inflated	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
33.20.06.94	raw	$0	$0	$2,750	$0	$0	$0	$0	$2,750	$0	$0	$0	$0
	inflated	$0	$0	$5,141	$0	$0	$0	$0	$5,960	$0	$0	$0	$0
33.20.06.95	raw	$0	$0	$2,000	$0	$0	$0	$0	$2,000	$0	$0	$0	$0
	inflated	$0	$0	$3,739	$0	$0	$0	$0	$4,335	$0	$0	$0	$0
33.99.19.90	raw	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440
	inflated	$9,587	$9,875	$10,171	$10,476	$10,790	$11,114	$11,447	$11,791	$12,144	$12,509	$12,884	$13,271
Total	**raw**	**$26,182**	**$26,182**	**$45,990**	**$26,182**	**$26,182**	**$26,182**	**$26,182**	**$45,990**	**$26,182**	**$26,182**	**$26,182**	**$26,182**
	inflated	**$46,139**	**$47,523**	**$85,982**	**$50,418**	**$51,930**	**$53,488**	**$55,093**	**$99,677**	**$58,448**	**$60,201**	**$62,007**	**$63,868**

ANNUAL OUTLAY
AND
PRESENT VALUE

3% Inflation Rate
6% Discount Rate
20% Contingency Applied

OPCC Section	YEAR >>>>	25	26	27	28	29	30	SUM	Present Value
33.01.03.04	raw	$2,474	$0	$0	$0	$0	$0	$14,844	$8,421
	inflated	$6,216	$0	$0	$0	$0	$0	$26,693	$13,499
33.01.03.08	raw	$1,504	$0	$0	$0	$0	$0	$9,024	$5,119
	inflated	$3,779	$0	$0	$0	$0	$0	$16,227	$8,206
33.01.03.14	raw	$2,474	$0	$0	$0	$0	$0	$14,844	$8,421
	inflated	$6,216	$0	$0	$0	$0	$0	$26,693	$13,499
33.02.03.01	raw	$157	$0	$0	$0	$0	$157	$1,099	$563
	inflated	$394	$0	$0	$0	$0	$457	$2,151	$941
33.02.05.02	raw	$3,760	$3,760	$3,760	$3,760	$3,760	$3,760	$116,560	$58,621
	inflated	$9,447	$9,731	$10,022	$10,323	$10,633	$10,952	$225,747	$99,459
33.02.09.02	raw	$24,240	$15,791	$15,791	$15,791	$15,791	$24,240	$555,664	$283,511
	inflated	$60,904	$40,865	$42,091	$43,354	$44,655	$70,605	$1,072,497	$476,993
33.02.11.90	raw	$324	$324	$324	$324	$324	$824	$9,710	$4,723
	inflated	$813	$838	$863	$889	$915	$943	$19,033	$8,162
33.20.06.90	raw	$221	$221	$221	$221	$221	$221	$6,641	$3,230
	inflated	$556	$573	$590	$608	$626	$645	$13,017	$5,582
33.20.06.91	raw	$295	$295	$295	$295	$295	$295	$8,861	$4,310
	inflated	$742	$764	$787	$811	$835	$860	$17,368	$7,448
33.20.06.92	raw	$351	$351	$351	$351	$351	$351	$10,521	$5,117
	inflated	$881	$908	$935	$963	$992	$1,021	$20,622	$8,843
33.20.06.93	raw	$0	$0	$0	$0	$0	$0	$664	$627
	inflated	$0	$0	$0	$0	$0	$0	$846	$798
33.20.06.94	raw	$2,750	$0	$0	$0	$0	$2,750	$19,250	$9,868
	inflated	$6,909	$0	$0	$0	$0	$8,010	$37,680	$16,483
33.20.06.95	raw	$2,000	$0	$0	$0	$0	$2,000	$12,000	$5,177
	inflated	$5,025	$0	$0	$0	$0	$5,825	$24,932	$9,516
33.99.19.90	raw	$5,440	$5,440	$5,440	$5,440	$5,440	$5,440	$163,206	$79,376
	inflated	$13,669	$14,079	$14,501	$14,936	$15,384	$15,846	$319,901	$137,179
Total	**raw**	**$45,990**	**$26,182**	**$26,182**	**$26,182**	**$26,182**	**$39,538**	**$942,887**	**$477,084**
	inflated	**$115,553**	**$67,757**	**$69,790**	**$71,883**	**$74,040**	**$115,164**	**$1,823,408**	**$790,122**

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 **Sheet 1 of 1**

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description					Quantity	Unit	Labor	Equipment	Material
33.01.03.04 Environmental Protection Plan									
Labor									
Assume 1 plan every 5 years = total of 6 plans									
P3	30	hrs/plan			180	hrs	$9,000 00		
P2	10	hrs/plan			60	hrs	$2 220 00		
T2	8	hrs/plan			48	hrs	$1 248 00		
C2	8	hrs/plan			48	hrs	$1 536 00		
Computer Time (1/2 labor hours)			@	$5.00 per hour	168	hrs	$840 00		
Source Labor rates are based on current professional billing rates									

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe				
P3		180	$50.00		Total A		$14,844.00	$0.00	$0 00
P2		60	$37.00						
T2		48	$26.00		Total B				
C2		48	$32.00						
					Total C				

Rental	Subcontractor	Miles	Computer Time	Taxable $
			$840.00	

WBS **33** **01** **03** **04**

Total cost for years 1 5 10 15 20 25 $2,474.00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 **Sheet 1 of 1**

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description					**Quantity**	**Unit**	**Labor**	**Equipment**	**Material**
33.01.03.08									
Site Safety and Health Plan									
Labor									
Assume 1 plan every 5 years = total of 6 plans									
P3	4	hr/plan			24	hrs	$1 200 00		
P2	20	hr/plan			120	hrs	$4,440.00		
T2	8	hr/plan			48	hrs	$1 248.00		
C2	8	hr/plan			48	hrs	$1 536.00		
Computer Time (1/2 labor hours)			@	$5 00 per hour	120	hrs	$600 00		
Source Labor rates are based on current professional billing rates									

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe
P3		24	$50.00	
P2		120	$37.00	
T2		48	$26 00	
C2		48	$32.00	

Total A	$9.024.00	$0.00	$0 00
Total B			
Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $
			$600.00	

WBS

33	01	03	08

Total cost for years 1. 5. 10. 15. 20. 25 $1 504 00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description					Quantity	Unit	Labor	Equipment	Material
33.01.03.14									
Quality Control Plan									
Assume 1 plan every 5 years = total of 6 plans									
Labor									
P3	30	hr/plan			180	hrs	$9,000.00		
P2	10	hr/plan			60	hrs	$2 220.00		
T2	8	hr/plan			48	hrs	$1 248.00		
C2	8	hr/plan			48	hrs	$1 536.00		
Computer Time (1/2 labor hours)			@	$5.00 per hour	168	hrs	$840.00		
Source Labor rates are based on current professional billing rates									

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe				
P3		180	$50.00		Total A		$14,844.00	$0.00	$0.00
P2		60	$37.00						
T2		48	$26.00		Total B				
C2		48	$32.00						
					Total C				

Rental	Subcontractor	Miles	Computer Time	Taxable $	WBS	33	01	03	14
			$840.00						

Total cost for years 1 5 10 15 20 25 $2,474.00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33.02.03.01 Miscellaneous Site Maintenance					
Labor					
Collect ambient air sample every five years					
Total ambient air samples = 7 samples					
duration = 1 hour					
Field Sampler P2	7	hours	$259 00		
Equipment Rental					
PID rental duration = 1 days/event	7	days		$840 00	
FoxboroTVA 1000 Dual FID/PID Analyzer = $120 day					
PID rental quote from Hazco 2000 Catalog					

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe
P2		7	$37 00	

Total A	$259.00	$840 00	$0.00
Total B			
Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $
$840.00				

WBS 33 02 03 01

Total cost for years 1 5 10 15 20 25 30 $157 00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description						Quantity	Unit	Labor	Equipment	Material
33.02.05.02										
Groundwater Sampling										
Labor										
Assumptions:										
8 wells will be sampled										
Groundwater monitoring will occur quarterly for first year				=	4 events					
and semiannually for duration of Postclosure Maintenance				=	58 events					
Total groundwater monitoring events				=	62 events					
P1	20	hrs/event				1 240	hrs	$34,720.00		
T2	20	hrs/event				1 240	hrs	$32 240.00		
Equipment										
Rental Equipment (including shipping and accessories costs)										
Water Level Indicator			@	$100	per event	62	each		$6,200.00	
PID			@	$300	per event	62	each		$18,600.00	
Oil/Water Probe			@	$100	per event	62	each		$6,200.00	
Horriba Water Quality Meter			@	$200	per event	62	each		$12,400.00	
Disposable Materials (including decontamination materials and packaging materials)										
			@	$100	per event	62	each			$6,200.00
Source Labor rates are based on current professional billing rates										
Equipment and material costs are assumed based on recent sampling events costs										

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe				
					Total A	$66,960.00	$43,400.00	$6,200.00
P1		1 240	$28.00					
T2		1 240	$26.00		Total B			
					Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $
$43,400.00				$6,200.00

WBS	33	02	05	02

Total Cost for Year 1: $7,520.00
Total Cost for all Other Years: $3,760.00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description					Quantity	Unit	Labor	Equipment	Material
33.02.09.02									
Groundwater Analysis									
Assumptions:									
Total groundwater monitoring events		=	62 events						
Number of wells to monitor		=	8 wells						
Number of laboratory analysis required		=	496 samples						
Required Analysis:									
Total Dissolved Solids	EPA 160 1	@	$12 93	per sample	496	each			$6,413 28
Chloride and Sulfate	EPA 300	@	$28 45	per sample	496	each			$14 111 20
Nitrates – Nitrogen	EPA 353 1	@	$15 16	per sample	496	each			$7 519 36
TPH Extractable as Diesel and JP-5	Modified 8051	@	$58 00	per sample	496	each			$28 768 00
TPH Purgeable as Gasoline	EPA 8015B	@	$51 04	per sample	496	each			$25 315 84
TRPH	EPA 418 1	@	$35.00	per sample	496	each			$17,360 00
Dissolved Metals[2]	CLP or EPA 6010B, 7470A, and 7196A or 7198	@	$25.00	per sample	496	each			$12 400.00
PCBs/Pesticides	CLP or EPA 8082/8081	@	$137 55	per sample	496	each			$68 224 80
Semivolatile Organic Compounds (SVOCs)[2]	CLP Method	@	$256 16	per sample	496	each			$127,055 36
Volatile Organic Compounds (VOCs)[2]	CLP Method	@	$136 73	per sample	496	each			$67,818 08
Vapam	EPA 531 1	@	$150.00	per sample	128	each			$19 200.00
Total Organic Carbon	EPA 415 1	@	$52.00	per sample	128	each			$6,656.00
Carbonate, Bicarbonate Alkalinity (as HCO_3)	EPA 310.1	@	$13 37	per sample	128	each			$1 711 36
Chlorinated Herbicides	EPA 8151A	@	$126.94	per sample	128	each			$16,248 32
Hexavalent Chromium	CLP or EPA 6010B, 7470A, and 7196A or 7198	@	$24 54	per sample	128	each			$3 141 12
Organo Phosphorus	EPA 8141	@	$150 00	per sample	56	each			$8 400.00
Required Validation:									
Total Dissolved Solids	EPA 160 1	@	$6 07	per sample	496	each			$3,010 72
Chloride and Sulfate	EPA 300	@	$13 35	per sample	496	each			$6,621 60
Nitrates – Nitrogen	EPA 353 1	@	$28 86	per sample	496	each			$14 314 56
TPH Extractable as Diesel and JP-5	Modified 8051	@	$19 55	per sample	496	each			$9,696 80
TPH Purgeable as Gasoline	EPA 8015B	@	$19 33	per sample	496	each			$9 587 68
TRPH	EPA 418.1	@	$10.50	per sample	496	each			$5,208.00
Dissolved Metals[2]	CLP or EPA 6010B, 7470A, and 7196A or 7198	@	$29 53	per sample	496	each			$14,646 88
PCBs/Pesticides	CLP or EPA 8082/8081	@	$29 52	per sample	496	each			$14,641 92
Semivolatile Organic Compounds (SVOCs)[2]	CLP Method	@	$30 10	per sample	496	each			$14 929.60
Volatile Organic Compounds (VOCs)[2]	CLP Method	@	$29 10	per sample	496	each			$14 433.60
Vapam	EPA 531 1	@	$15.00	per sample	128	each			$1 920.00
Total Organic Carbon	EPA 415 1	@	$9 90	per sample	128	each			$1 267 20
Carbonate, Bicarbonate Alkalinity (as HCO_3)	EPA 310.1	@	$9 67	per sample	128	each			$1 237 76
Chlorinated Herbicides	EPA 8151A	@	$25 79	per sample	128	each			$3 301 12
Hexavalent Chromium	CLP or EPA 6010B, 7470A, and 7196A or 7198	@	$10 37	per sample	128	each			$1 327 36
Organo Phosphorus	EPA 8141	@	$31.00	per sample	56	each			$1,736.00
Shipping:									
Each event generates 2 coolers full of sample containers @ $60/cooler		@	$120.00	per ship	62	each			$7,440.00

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe					
					Total A		$0 00	$0.00	$555,663 52
					Total B				
					Total C				

Rental	Subcontractor	Miles	Computer Time	Taxable $
$0.00	$555,663.52			

WBS: 33 | 02 | 09 | 02

Total Cost for Year 1: $47 032 32
Total Cost for Years 5, 10, 15, 20, 25 30 $24 240 16
Total Cost for all Other Years: $15,790.88

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description				Quantity	Unit	Labor	Equipment	Material
33.02.11.90								
Soil Moisture Probing								
Assumptions:								
Soil moisture probing will occur annually for duration of Postclosure Maintenance								
Total testing events		=	30 events					
Testing shall include:								
Soil moisture probe at 9 locations	duration	=	1 hour	30	hours	$830.10		
General Laborer								
Data analysis			8 hr/year	240	hour	$8,880.00		
P2								
Assume contractor owns probe								
Source								

Davis-Bacon and P-Level Summary							
Category	Code	Hours	Direct	Fringe			
					Total A	$9,710.10	$0.00	$0.00
General Laborer		30	$18.18	$9.49				
P2		240	$37.00		Total B			
					Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $	WBS	33	02	11	90
$0.00			$0.00						

Total Cost for all Years: $323.67

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33 20.06.90 Monthly Inspection					
Assumptions:					
Total monthly inspections: Assume that during the quarterly semi-annual and annual inspection events, monthly inspections are conducted **Total monthly inspections (8/yr)** = 240 events					
Labor					
Monthly inspection includes: inspect signs and gates duration = 1 hour					
General Laborer	240	hour	$6,640.80		
Source					

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe
General Laborer		240	$18 18	$9.49

	Labor	Equipment	Material
Total A	$6,640.80	$0.00	$0.00
Total B			
Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $

WBS 33 20 06 90

Total Cost for all Years: $221 36

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33.20.06.91					
Quarterly Inspection					
Assumptions:					
Total quarterly inspections:					
Assume that during the semi-annual and annual inspection events, quarterly inspection is conducted					
Total quarterly inspections (2/yr) = 60 events					
Labor					
Quarterly inspection includes:					
1 inspect signs and gates duration = 1 hour					
General Laborer	60	hour	$1,660.20		
2 visual cover walk duration = 1 hour					
General Laborer	60	hour	$1,660.20		
3 final grading walk duration = 1 hour					
General Laborer	60	hour	$1,660.20		
4 wildlife search duration = 1 hour					
Biologist	60	hour	$2,220.00		
5 gas vents inspection	60	hour	$1,660.20		
General Laborer					

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe
General Laborer		180	$18.18	$9.49
Biologist		60	$37.00	

Total A	$8,860.80	$0.00	$0.00
Total B			
Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $

WBS	33	20	06	91

Total Cost for all Years: $295.36

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33.20.06.92					
Semi-annual Inspection					
Assumptions:					
Total semi-annual inspections:					
Assume that during the annual inspection events semi-annual inspection is conducted.					
Total semi-annual inspections (1/yr) = 60 events					
Labor					
Semi-annual inspection includes:					
1 inspect signs and gates duration = 1 hour					
General Laborer	60	hour	$1,660.20		
2 visual cover walk duration = 1 hour					
General Laborer	60	hour	$1,660.20		
3 final grading walk duration = 1 hour					
General Laborer	60	hour	$1,660.20		
4 wildlife search duration = 1 hour					
Biologist	60	hour	$2,220.00		
5 drainage erosion check duration = 1 hour					
General Laborer	60	hour	$1,660.20		
6 gas vents inspection duration = 1 hour					
General Laborer	60	hour	$1,660.20		
Source					

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe				
					Total A	$10,521.00	$0.00	$0.00
General Laborer		300	$18.18	$9.49				
Biologist		60	$37.00		Total B			
					Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $	WBS	33	20	06	92
	$10,521.00								

Total Cost for all Years: $350.70

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33 20.06.93 Ground Surveys					
Assumptions: Ground survey will be conducted in years 1 2 and 3					
Total Ground surveys conducted = 3 surveys					
Labor: Survey will take one 8 hour day					
8 hrs x 3 surveys	24	hours	$664 08		

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe				
General Laborer		24	$18 18	$9 49	Total A	$664 08	$0 00	$0 00
					Total B			
					Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $	WBS	33	20	06	93
$0.00			$0.00						

Total cost for years 1 2 3 $221 36

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33 20.06.94 Aerial Surveys					
Assumptions: Aerial survey will be conducted on 5 year intervals					
Total Aerial surveys conducted = 7 surveys					
Labor: Fly over and photograph and generate topographic map. = $2,750 per event	7	event		$19,250.00	
Quote by WM Holdings, Inc. Meagher Land Surveyor (805) 677-4850					

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe

	Labor	Equipment	Material
Total A	$0.00	$19,250.00	$0.00
Total B			
Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $
	$19,250.00		$0.00	

WBS: 33 | 20 | 06 | 94

Total cost for years 1, 5, 10, 15, 20, 25, 30 $2,750.00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 **Sheet 1 of 1**

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: SWF	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description	Quantity	Unit	Labor	Equipment	Material
33 20 06 95 Periodic Leak Search *Assumptions:* Leak search will be conducted on 5 year intervals by analyzing groundwater monitoring data. Total analyses = 6 ea *Labor:* P3 = 40 hrs/ea	6	ea	########		

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe				
P3		240	$50 00		Total A	########	$0.00	$0 00
					Total B			
					Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $
			$0.00	

WBS	33	20	06	95

Total cost for years 5, 10, 15, 20, 25, 30 $2 000 00

Tetra Tech EM Inc.

Calculation Worksheet for Cost Opinions

J/N: G0069-206E0201 Sheet 1 of 1

Project			
Naval Base Ventura County Port Hueneme Site Installation Restoration Program Site 14 Landfill Cover Postclosure Maintenance Plan			
Prepared by: ELM	**Date:** 6/12/2000	**Checked by:** RGH	**Date:** 8/24/2000

Description						Quantity	Unit	Labor	Equipment	Material
33 99 19 90										
Project Management										
Labor										
Reporting										
Mail (1 per month)			=	$5	each	360	each			$1,800.00
Phone (5 long distant calls per month)			=	$5 31	each	1800	calls			$9,558.00
Copies (20 per month)			=	$0 09	each	7200	copies			$648.00
Contract Maintenance										
P3	8	hrs/month				2880	hrs	$144,000.00		
Computer Time (1/2 labor hours)			@	$5 00	per hour	1440	hrs	$7 200.00		
Source Labor rates are based on current professional billing rates										

Davis-Bacon and P-Level Summary

Category	Code	Hours	Direct	Fringe
P3		2880	$50.00	

Total A	$151 200.00	$0.00	$12,006.00
Total B			
Total C			

Rental	Subcontractor	Miles	Computer Time	Taxable $
			$7,200.00	

WBS 33 99 19 90

Total Cost per Year: $5 440 20

APPENDIX F

CONCURRENCE OF IWMB REGARDING PRESENCE OF METHANE GAS
Scott Humpert of IWMB to Omoruyi Patrick of DTSC
January 15, 1999

California Integrated Waste Management Board

Daniel G. Pennington, Chairman
8800 Cal Center Drive • Sacramento California 95826 • (916) 255-2200
www.ciwmb.ca.gov

w inston H. Hickox
Secretary for
vironmental
otection

Gray Davis
Governor

January 15, 1999

Mr. Omoruyi Patrick
Department of Toxic Substances Control
Office of Military Facilities
5796 Corporate Avenue
Cypress, CA 92132-4700

SUBJECT: PROGRAM SITE 14, NAVAL CONSTRUCTION BATTALION CENTER (NCBC) PORT HUENEME, SWIS NO. 56-CR-0039

Dear Omo:

This letter is sent to notify you that the revisions to the soil erosion calculations and the review of the 100-year/24-hour storm event rainfall values for Site 14 are correct and sufficient. I have also reviewed and concur with the results of the February 1998 evaluation of the potential for methane gas generation at the above site.

If you have any questions please call me at (916) 255-3833.

Sincerely,

Scott S. Humpert, P.E.
Associate Waste Management Engineer
Permitting and Enforcement Division
California Integrated Waste Management Board

cc: Mike Wochnick, California Integrated Waste Management Board
Dennis How, Naval Facilities Engineering Service Center
Todd Margrave, Naval Facilities Engineering Service Center

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